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healthcare within reach
A focus on Intraoperative Awareness

With the release of the Bollywood film “Heartless” (based on the 2007 Hollywood film “Awake”) a couple of months ago, the possibility of Intraoperative Awareness (AWR) is yet again causing some patients who are due to undergo general anesthesia and surgery considerable distress. What is AWR, what are the consequences, what is the incidence of the condition and how can it be prevented from occurring?

AWR is currently defined as “consciousness under general anesthesia with subsequent recall of the experienced events”. Awareness is less traumatic if it occurs under anesthesia but before or after surgery. Awareness during surgery, reported as occurring in around a third of AWR cases, can result in catastrophic long-term psychological sequelae. Whether AWR occurs before, during or after surgery, it causes around 70% of patients to suffer from post-traumatic stress disorder.

The incidence of AWR continues to generate controversy. Reported incidences from several US multicentre studies involving thousands of patients range from 0.13 to 0.2% of patients. Prospective clinical trials in the UK had reported similar incidences of between 0.1 and 0.2%, but a recent UK national survey involving over 300 hospitals and over 7,000 anesthetists recorded much lower incidences of 0.006%, while a recent study from Germany reported incidences from 0.1 up to 1% in ‘high risk adults’. If anxious patients are to be given relevant information and studies on prevention are to have a sound base, it is imperative that incidence data are robust.

Prevention of AWR should involve thorough preoperative assessment of the patient, ascertaining that equipment is functioning optimally and prudent choice of drugs. However monitoring of the depth of anesthesia is crucial if AWR is to be prevented, yet surveys show that monitors such as the bispectral index monitor (BIS), first approved by the FDA 18 years ago, are not always used even when they are available. Although the design of some of the clinical trials on their use can be criticized, the body of evidence strongly suggests that brain monitoring effectively reduces the incidence of AWR.

The 9th International Symposium on Memory and Awareness in Anesthesia (MAA9) will take place in Tokyo from July 20th-23rd. The triennial MAA symposium is an interdisciplinary platform where anesthetists are joined by psychologists, neuroscientists, physicists and biomedical engineers in their efforts to understand the mechanisms of AWR. This year’s symposium is expected to focus heavily on anesthesia depth monitoring and strategies to prevent AWR. Hopefully the fear of AWR (as well as the dubious medical thriller films that exacerbate that fear) will soon be things of the past.

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“The health of our patients is a shared responsibility”, says resident Marie Elisabeth Jaeger. “As a team, we need to have all lab results, diagnoses and details of medication in one place, so that everyone who needs them can access them immediately. The University Medical Center Hamburg-Eppendorf uses the hospital information system, Soarian Clinicals from Siemens, to ensure that this is achieved. It bundles patient information and gives immediate access: for consultations, examinations, therapy sessions, and via mobile equipment also on the rounds. While this helps the team at the medical center, it mainly benefits the patients: “It gives me reliable data and time for a more personal level of care. And for most patients this is just as important and beneficial as the actual therapy itself.”

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Image-guided surgery

Image-guided surgery (IGS) involves correlating pre-surgical images of an operative area and its adjacent anatomic structures to a surgical instrument, and achieving this with a high degree of precision, in real time.

IGS, in some senses, can be considered as an enhancement of minimally invasive surgery (MIS), which became widespread during the 1980s and early 1990s. Like IGS, MIS too had the goal of providing precise access and reducing collateral damage to nearby tissue during a surgical procedure.

IGS and Computer Assisted Surgery

IGS is now seen as a key component of computer assisted surgery (CAS), a methodology to use computers in the surgical process, all the way from pre-operative planning to intervention and post-surgery assessments. The two terms were often used interchangeably in the past, and still overlap in several features and applications, such as the use of virtual or augmented reality.

However, given the emergence in its own right of another specialty application, robotic surgery, CAS is now differentiating itself from IGS.

Graphic processor capabilities drive IGS

Both CAS and IGS were driven by the explosive growth of computing power in the late 1990s and the consequent availability of structured patient information in the operating theatre.

IGS, however, has a more targeted heritage in the field of graphic processor units (GPUs). Aided by advanced algorithms in areas such as dynamic texture binding, texture sampling, rendering and image compositing, these have enabled “real-time visualization of volumetric multimodal images in a real-world medical environment,” with adequate image quality, computational precision and reliability for guidance during surgical intervention.

Cushioned by the demand for high-performance graphics from mass market gaming applications, prices of GPUs declined in relative terms and made the take-up by hospitals realistic, while compelling vendors to still continue enhancing their performance.

One example of the crossover between gaming and IGS is an assessment of the Microsoft Kinect for X-box 360 to track “respiratory and body motion in diagnostic imaging and external beam radiotherapy,” and its potential for “many other biomedical applications.”

Imaging and surgical intervention: a 120-year lineage

The above trends in graphics technology also propelled the use of high-performance CTs, MRIs and ultrasound scanners, and it was only a question of time before patient data from imaging devices moved from diagnostic facilities to the operating theatre. As a result, it became possible “to combine images obtained during surgery with high-resolution 3D scans of a patient acquired before surgery” and fuse “sensor feeds from multiple modalities, such as intraoperative MRI and CT scans”, to provide surgeons with in-depth, real-time views of a region of interest.

Indeed, it is interesting to note that the connection between imaging and surgical intervention goes back almost 120 years. Just about a week after Wilhelm Röntgen announced the discovery of X-Rays in 1885, a Birmingham-based surgeon called J.H Clayton used a bromide print of an X-ray to remove an industrial sewing needle from a woman’s hand.

The framework for IGS

A typical framework for IGS consists of several steps:

- The acquisition of a set of medical (MRI, CT or US) images of the relevant portion of a patient’s anatomy.
- Segmenting them into distinct anatomical structures, yielding a 3D patient-specific model.
- Registering the model to a patient’s actual position on an operating table, enabling augmented reality visualizations.
- Tracking surgical instruments relative to both the patient and model in real time, allowing the execution of surgical procedures and the avoidance of hidden, critical structures.

Integrated IGS systems also seek to record and help analysing “differences between the pre-operative data and the intra-operative reality.”

Roots in neurosurgery

IGS, in present form, was developed for neurosurgery in the mid-1990s, and aimed at locating and accessing intracranial lesions or tumours, either for biopsy or removal, with minimal risk to surrounding brain tissue.

The neurosurgical application for IGS was inspired by the longer-running practice of stereotaxis, by virtue of which mechanical devices are used to position instruments such as probes, electrodes and cannulas in 3D. The use of stereotaxis in the brain was described by Robert Henry Clarke and Victor Horsley in 1906, when they credited it with the ability to investigate and record “every cubic millimeter of the brain.”
Application spectrum steadily grows
In the late 1990s, IGS moved to another traditionally difficult area, otolaryngology, which faced similarly daunting challenges from complex and sensitive nearby tissue, in the orbit and brain. One of the leading IGS applications has been endoscopic sinus surgery (ESS), especially in areas which abut the skull base or extend into the frontal or sphenoid zones.

Other fields where similar concerns opened the door for IGS include spine and orthopedic procedures. As mentioned, IGS dovetailed with over a decade of growth in MIS, and one of the first areas where the two cross-fertilized each other was in spinal surgery, especially screw fixation. Transpedicular screw misplacement was a frequent cause for neurovascular complications, with the risk of cortex perforation occurring in almost one of 5 patients in the 1980s. Since then, IGS has significantly improved the accuracy of the placement and "enabled a reduction in surgical exposure, duration, and blood loss." IGS is now used in a wide range of spinal procedures, including odontoid screw insertion, interbody cage placement and atlantoaxial transarticular screw fixation.

Emerging IGS applications
Emerging CT-based IGS applications include transcatheter aortic valve replacement, continuous bronchoscope guidance for lung cancer staging, and for other procedures against cancer such as radiofrequency ablation (RFA). Cone-beam CT offers opportunities to directly localize tumors in the operating room, reducing the cost and logistical burden of preoperative localization.

One interesting development is renewed attention to an earlier imaging technology - ultrasound. Until recently, real-time 3D ultrasound in IGS applications was handicapped by the data loads on traditional tracking. However, techniques like radon-transform based instrument detection enabled such obstacles to be addressed by the mid-2000s. This, in turn, has opened the way for IGS opportunities in areas such as cardiac surgery, where it does away with the traditional need for stopped-heart interventions.

More recently, 3D real-time ultrasound images have been used in beating heart transapical mitral valve repair, widening the IGS application window to a high risk patient population. Aside from cardiac applications, ultrasound has also recently been demonstrated as a surface digitization tool in image guided liver surgery, and for transrectal biopsy in prostate cancer. One of the most exciting frontiers, however, may lie in reducing re-expansion in breast-conserving tumour-resection surgery; ultrasound IGS has shown potential in compensating for soft-tissue deformation which occur during breast-conserving surgery.

IGS no substitute for surgeon’s experience
In spite of all this, there still are reasons to remain conservative about IGS. Even in one of its mainstay applications, sinus and skull base surgery, experts warn that the technology "has its limitations", principally due to "the critical initial step of registration," where "even subtle errors can have profound consequences." As a result, IGS should not be seen as a substitute for a surgeon's expertise.

In late 2012, a 7-year study (2003-2010) on IGS applications in a range of conditions, including chronic otitis media, glomus jugulare, atresia, cerebrospinal fluid leak and cholesterol granuloma, established 11 anatomic landmarks, and found a mean accuracy within 1 mm in 10 of the latter. The study was, however, cautious in its findings - that IGS "may" improve outcomes. It, too, warned that IGS could not replace surgical expertise.

Fusing imaging data
Clearly, more experience with IGS is required before it achieves its full potential. Given the crucial role of imaging data, one focus is on CT and MRI technologies, where there have been some recent successes. One such case is the fusing of MRI and CT images which is enabling IGS practitioners to benefit from the relative superiority of MRI in delineating soft tissue and of CT in providing greater definition and detail with bony structures. Elsewhere, ultrasound data has been fused with MRI for diagnosis and treatment planning in prostate cancer.

Long-term drivers
In the longer term, future drivers for IGS are likely to be those which enable greater accuracy, speed, convenience and safety. Pre-procedural rehearsal simulators, for example, are permitting surgeons to add observations that are available in real-time during surgery. Other areas include head-tracking systems, some derived from the military, and above all, robotics. A recent initiative to develop tracking systems for MRI-guided robots in the US seems to address a major concern for IGS, namely the dependency on registration. The researchers have developed an algorithm using multiple images to calculate the robot's position and orientation, as opposed to the single image methodology used in the past.

Indeed, robotics are emerging as one of the most exciting applications for IGS, with novel systems, several based on MRI, opening wholly new frontiers. At Harvard Medical School, an ultrasonic motor-actuated needle guide is being evaluated for MRI-guided transperineal prostate intervention, while IGS systems for placing deep brain stimulation electrodes promise new methods of fighting Alzheimer's and Parkinson's. Other recent initiatives include a modular robotic system, with precision closed loop controlled piezoelectric motors, which has achieved "better than 0.01mm positioning accuracy." The system was used in percutaneous prostate intervention, but its promoters see this only as an illustrative case.

In the long run, the biggest promise for IGS may lie in the continuing development of graphic processor units (GPUs), the workhorse of modern imaging systems and the source of much of the data used by a surgeon. According to the International Technology Roadmap for Semiconductors, traditional computer processors face an end to the era of Moore’s Law, which witnessed computing power double every two years since 1958. In contrast, GPU pioneer NVIDIA sees his fifth-generation Tegra chips not only continuing to comply with, but effectively “breaking Moore's Law”. In five years time, Tegra's power is projected to grow 100 times, as against the e-fold increase which would have been suggested by Moore's Law"
Gene mutation defines brain tumours that benefit from aggressive surgery

Astrocytomas are the most common malignant brain tumours. While most patients’ tumours prove to be quite aggressive, outcomes overall can vary widely, with some patients surviving for many years. Now a new study has found that malignant astrocytoma patients whose tumours carry a specific genetic mutation benefit greatly from surgical removal of the largest possible amount of tumour. A type of glioma, astrocytomas include the highly aggressive glioblastoma and the less aggressive but still dangerous anaplastic astrocytoma.

“We found that the benefit of surgery and how aggressively the surgery should be done depend, in large part, on whether or not patients’ tumours have the mutated form of the IDH1 gene,” says Daniel Cahill, MD, PhD, of the Pappas Center for Neuro-Oncology in the Massachusetts General Hospital (MGH) Cancer Center, who led the study. “Under the prior system of categorization, these tumours were considered the same diagnosis and were treated the same way; but we have found that this mutation identifies a completely different subclass of glioma that probably should be treated differently.” Now an assistant professor of Neurosurgery at Harvard Medical School, Cahill was at the University of Texas MD Anderson Cancer Center when the study was initiated, and all study participants were treated at MD Anderson.

Ian McCutcheon, MD, professor of Neurosurgery at MD Anderson Cancer Center, who co-led the study with Cahill, adds, “We have long wondered why some patients with malignant glioma live much longer than others despite having been treated with similar approaches.” In 2008 a comprehensive genetic analysis of glioblastomas found IDH1 mutations in more than 10 percent of patients’ tumours, and subsequent studies have found similar mutations in 50 to 70 percent of anaplastic astrocytomas. Significant clinical differences between IDH1-mutant tumours and those without that mutation have been identified previously; patients with mutant tumours tend to be younger and survive longer, and the tumours are more likely to be located in the frontal lobe.

The current study was designed to investigate whether the presence or absence of the IDH1 mutation might help determine the optimal treatment strategy – in particular, how extensive surgery should be. Traditionally, how much of a brain tumour is removed depends on its location and whether that tissue can be safely removed. A key question has been whether to take out only the most actively growing part of the tumour – what is called “enhancing disease” – or also to remove the non-enhancing edge of the tumour that infiltrates adjacent tissue.

McCutcheon says, “This study shows that aggressive surgical removal of tumour leads to long survival when tumours carry a particular molecular signature – in this case the IDH1 mutation – but not when that mutation is absent. In current surgical planning, tumour location drives how aggressive a removal we obtain. Our results suggest that we should take the risk of maximum tumour removal not in all patients but in those whose tumour mutation status suggests they will benefit most.

Source: Massachusetts General Hospital
http://tinyurl.com/pjtsmj

New surgical glue could provide alternative for heart procedures

People who need multiple surgeries for congenital heart defects undergo procedures that are invasive and challenging partly due to an inability to quickly and safely secure devices inside the heart. Sutures take too much time to stitch and can stress fragile heart tissue, and available clinical adhesives are sub-par.

The creation of a safe and effective adhesive that can be used internally in the body would help these patients, but researchers trying to develop a glue like this have faced hurdles such as ensuring that it is non-toxic and capable of repelling fluids. Now, a study published by Harvard Medical School offers a potential breakthrough.

“Current glues are either toxic or easily wash out in the presence of blood or react immediately upon contacting water,” said the study’s senior co-author, Pedro del Nido, HMS William E. Ladd Professor of Child Surgery and chief of cardiac surgery at Boston Children’s Hospital. “The available options also tend to lose their sticking power in the presence of blood or under dynamic conditions, such as in a beating heart.”

In a pre-clinical study, del Nido and colleagues from HMS, Boston Children’s, Brigham and Women’s Hospital and MIT developed a non-toxic biologically inspired adhesive that can rapidly attach biodegradable patches inside a beating heart in the exact place where a hole occurs, such as with ventricular heart defects.

Many creatures in nature have secretions that are viscous and repel water, enabling them to attach under wet and dynamic conditions. Inspired by these examples, the researchers developed a material with these properties that is also biodegradable, elastic and biocompatible. They found that degradable patches secured to the heart with this glue remained attached even at increased heart rates and blood pressure.

“This adhesive platform addresses all of the drawbacks of previous systems in that it works in the presence of blood and moving structures,” said del Nido. “It should provide the physician with a completely new, much simpler technology and a new paradigm for tissue reconstruction to improve the quality of life of patients following surgical procedures.”

“To our knowledge this is the first demonstration that an adhesive can bond to wet tissues and seal them without being impacted by the presence of blood,” said co-senior author Jeffrey Karp, HMS associate professor of medicine and co-director of the Center for Regenerative Therapeutics at Brigham and Women’s. “Importantly, we showed that the tissue glue can seal holes in high-pressure dynamic tissues including blood vessels and myocardium.”

Moreover, because the glue’s adhesive abilities are activated with ultraviolet (UV) light, it can provide an on-demand, anti-bleeding seal within five seconds of UV light application when applied to high-pressure large blood vessels and cardiac wall defects.

The researchers suggested that their waterproof, light-activated adhesive will be useful in reducing the invasiveness of surgical procedures, shortening operating times and improving heart surgery outcomes.

Harvard Medical School
http://tinyurl.com/mq9n4pl
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Healthcare and the cloud: towards a hCloud?

Cloud computing is rapidly emerging as a preferred solution for the challenges of Big Data, mobility and access to information on demand, any time, from anywhere. Although a late arrival to the scene, healthcare has been making up for lost time in terms of embracing the Cloud.

Healthcare and Big Data

In reality, there is little choice. Healthcare is among the largest contributors to Big Data, not least because of the explosion in massive graphic files which constitute Picture Archiving and Communication Systems (PACS). Coping with exabytes of information, growing by the second, has made traditional physical storage a relic. Data storage has become virtual, with the computing process moving to the data rather than the other way round.

In the healthcare context, this is pertinent given that physician interaction with PACS and other clinical information systems is what gives the data meaning. With 75% of physicians using a smartphone and more than 10,000 mobile health applications already in use, healthcare carries some of the biggest and most exacting requirements for mobility, scalability and security.

The above scenarios are central to the Cloud computing offer, and they have guided its development and refinement from the outset.

The Cloud: enhancing healthcare quality and cost-effectiveness

Cloud computing technologies can assist healthcare providers “to improve the quality of medical services and the efficiency of operations” and to crucially, facilitate “the synchronized and authorized sharing of data.” The Cloud is also cost-effective, with savings of up to almost 10 times compared to traditional systems, according to consultants Frost & Sullivan.

One recent impetus to healthcare adoption of the Cloud is that providers are being joined by several other players, from medical device manufacturers to drug development firms, and even patients. Indeed, “cloud computing is already integrated into the design of some innovative new diagnostic procedures.” “Commercial cloud vendors including Amazon, IBM, and Oracle have developed pharma-specific clinical research cloud offerings with the goal of lowering the cost and development of new drugs.”

These developments are likely to converge in the future in giving critical mass to the healthcare facet of the Cloud. Before this, however, some challenges still lie ahead, not least in clarifying what the Cloud is, and what it is not.

New paradigm in computing

The Cloud marks a new paradigm in computing, such as the 1970s transition from punch cards to keyboard programmable mainframes, the advent of client-server networks in the 1980s, the Internet in the 1990s and mobile computing in the 2000s. In its own frame of reference, the Cloud has sounded the death knell for test runs in the late 2000s with other hosted infrastructure sharing solutions such as pay-as-you-go, application service provider (ASP) programs. It also seems to be eclipsing its close cousin, Software-as-a-Service (SaaS).

In some senses, the Cloud is a natural next step in the evolution of information and communication technology. As mentioned, it has parallels to SaaS, and the two terms continue to be used interchangeably. This was also the case with SaaS and its predecessor, ASP both of which were ‘hosted’ and like Cloud computing, available on demand.

The Cloud’s forerunners

However, there were major differences between ASP and SaaS (or the Cloud). ASP simply provided remote access to legacy software, which, in effect, was ‘rented’ by a user for a period time. Its biggest shortcoming was a lack of scalability. It operated simply as a service provision ‘pipeline’ to a user, and lacked the capacity to collect and aggregate data from multiple users.

This was a fatal handicap, given the growing presence of structured, loosely-structured and unstructured voice, text and other forms of data from disparate sources such as mobile telephones, through sensors, to social media, click streams and blogs. The success of Facebook and Twitter are testimony to the importance of combining user-driven feedback and interaction with near real-time analysis and data updates.

The requirements of the emerging world of eHealth are similar.

The Cloud and SaaS

Differences between the Cloud and traditional SaaS are more nuanced, while similarities are clear-cut. Both enable data centres to be run like the Internet, offering remote on-demand access to applications and storage. They also entail low upfront investment and reduced costs of operation, and higher downtime, since maintenance and upgrades are done remotely. Lastly, they provide similar levels of disaster readiness.

The US National Institute of Standards and Technology (NIST) specifies five essential characteristics for the Cloud: on-demand self-service (no user interaction with service providers), broad network access (from workstations to mobile phones), pooling
of physical and virtual resources (dynamically assigned and reassigned based on user demand), rapid elasticity (instant up-scaling) and a metering service to determine usage by individual users. There are three service models: “Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS) and Infrastructure as a Service (IaaS),” which are deployable “over a private cloud, a public cloud, a community cloud or a hybrid cloud.”

Key differences versus SaaS: relevance for healthcare
The key differences, where pure-play (but still) emerging Cloud platforms score over traditional SaaS are subtle, but some of these may have direct relevance for healthcare users.

In the Cloud, the browser front-end is backed by critical application sets that both mimic the look and feel of a desktop application and have similar response times. Unlike traditional SaaS, where features are written into the software and provided on a take-it or leave-it basis, the Cloud allows for hands-on customization of programs to a user’s needs.

The Cloud offers more flexibility. Users can calibrate server capacity requirements and storage space, based on requirements, and pay according to usage. SaaS has typically required a fixed monthly (or annual) fee per user.

Alongside, Cloud users are responsible for maintaining applications on the server. As a result, they can outsource its maintenance to specialist firms, who in turn can bring in new servers and add capacity online in hours. For SaaS, end users are removed from maintaining both the application and the server equipment.

In short, cloud computing is highly customizable, whereas SaaS is essentially limited to a one-size-fits-all approach.

The Cloud and security
The biggest advantage with the Cloud is security. Traditional SaaS is Web-based, and users can be contaminated by threats such as viruses and Trojans in public Websites. Cloud applications run within virtual private networks, which are hermetic. In other words, they are as close as possible to the ultimate frontier of security, a computer with no Internet connection.

For healthcare, the security offered by the Cloud has become the key driver of acceptance.

Based on the NIST definition referred to previously, traditional SaaS would largely be limited to the first of three service models, and be deployed on a public or community model, while pure-play Cloud would consist of PaaS and IaaS (Cloud Platform as a Service, and Infrastructure as a Service), and be deployed only on a private model.

It is likely that differences between the two get enhanced with time and definitions cleave apart, as vendors differentiate their customer value propositions, while technologies too take their own course.

NIST itself leaves this possibility open, noting at the outset that “Cloud computing is an evolving paradigm” and that its definition is based on “simple taxonomy”. Examples of emerging pure-play Cloud offerings on the market are Microsoft’s Azure, Amazon’s S3 and Rackspace.

In both the US and Europe, the healthcare sector’s adoption of the Cloud has been hampered by concerns over security and privacy, in its core SaaS incarnation. In spite of its numerous attractions, the open door to the Web associated with traditional SaaS provoked resistance from healthcare adopters. Their key concern was compliance with the strict patient health data provisions of HIPAA (the Health Insurance Portability and Accountability Act) in the US and follow-ups to the EU Data Protection Directive 95/46.

In Europe, legal responsibility for protecting data in the Cloud remains with a healthcare provider, not the Cloud service provider. In late 2012, the EU Commission published a Communication (an approach paper) about its Cloud computing strategy, but this had little specific to say about the healthcare sector, aside from making general references to its utility for e-Health.

Healthcare standards for the Cloud
Such barriers are, nevertheless, slowly being chipped away at, with the arrival of new standards-led Cloud offerings developed for Health Information Exchanges (HIE). HIEs are essentially clearing houses for the exchange of data between hospitals, clinics, physicians and the health authorities, and have benefited from billions of dollars in federal funding in the US.

On their part, many vendors have coupled their HIE Cloud offerings to potentially the biggest driver of adoption, namely user demand. The first point of call for applications here is medical imaging, where the sheer volume of data which is now generated cannot be handled by traditional, in-house PACS solutions any more, both in terms of ownership cost and storage capacity. In the US, the Cloud computing market for medical images is estimated at $56.5 million in 2010 and is forecast to attain compounded growth of 27% a year to reach $383.1 million in 2018.

The potential of the healthcare Cloud market is not only illustrated by these figures, but in its novelty too. Most companies with PACS cloud solutions are less than five years old and only two of the major enterprise PACS players currently have solutions in the PACS Cloud market. A good illustration to the cleavage between traditional SaaS and pure-play Cloud is that healthcare IT giants GE Healthcare and McKesson offer web-based PACS SaaS solutions, but do not (yet) offer it in a Cloud computing architecture.

Towards a hCloud
One of the most intriguing possibilities at the moment is that the specific requirements of healthcare converge to produce a new hCloud, with security and privacy protection features - based on new standards - determining its features and functionalities, rather than evolving as add-ons.
The CIRSE Annual Meeting is by far the largest and most significant platform for minimally invasive, image-guided medicine, welcoming over 6,500 delegates from 94 countries in 2013.

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Sharing images across 11 UK trusts

The Cheshire and Merseyside Consortium is made up of eleven trusts in the area, including Aintree University Hospitals, Clatterbridge Centre for Oncology, Liverpool Community Health, Liverpool Heart and Chest Hospital, Liverpool Women’s, Royal Liverpool and Broadgreen University Hospitals, and St Helens and Knowsley Teaching Hospitals. The consortium recently procured the Carestream Vue PACS v11 as a managed service.

Peter Rowlands, Consultant Radiologist at Royal Liverpool University Hospital explained the background: ‘Cheshire and Merseyside is an unusual area. There are multiple trusts in a small geographic area with a number of specialist hospitals, so it has always been a challenge to have patients moving around between hospitals. There’s currently around a million and a half exams a year across the consortium with more and more studies being done; each study has more data in it, so the amount of data being transferred increases. More of our people now work across different sites and supporting that activity and making it easier for images to be acquired in one site and reported on another were high priorities for us.’

PACS Manager at Royal Liverpool University Hospital, Sharron Dyce was part of the procurement team: ’I think the biggest achievement was bringing eleven trusts together and keeping them together right through to deployment. We’ve been live over six months and we’re already realizing the benefits of image sharing across the community.’

‘In the procurement process you aim to get the most effective, as well as the most feature-rich system to meet the needs of each trust,’ went on Sharron. ‘Carestream has a lot of advanced features such as CT reconstruction already standard within their system where others didn’t.’

Sharron also recognized the benefits of having a direct relationship with the system supplier. ‘Under the Local Service Provider arrangements there was always a middle man,’ said Sharron. ‘From a manager/administrator point of view I can now go directly to Carestream and immediately be in touch with an engineer who can help me straight away.’

Now that the new PACS is in operation, what clinical benefits have Peter Rowlands and the radiology team across Cheshire and Merseyside seen? ‘When we’re reporting we have access to previous studies which means we can report the scan there and then, and that’s a big advantage for radiologists,’ he said. ‘We’re also seeing a lot of the anomalies of the previous situation, particularly with image transfer, disappearing. It’s a very popular system.’

Multi-disciplinary meetings

Multi-disciplinary meetings are also much easier to facilitate now. Previously, two or three days before a meeting, all of the images had to be imported, which was very time consuming, so that’s a big advantage. Recently we’ve also had a pilot scheme with registrars reporting out of hours work for two hospitals and this would not have been possible in the previous PACS situation,’ continued Peter.

‘Our aim is to take visible light or endoscopic images and incorporate those in PACS so that the patient folder has all of the images whether they’re visible light, pathology, X-ray or MR.’

Concerning multi-disciplinary meetings, Sharron received a positive message from a Consultant Oncologist at Clatterbridge: ‘what a difference the region-wide PACS makes to us. When patients cross between the specialist small hospitals and the large hospitals, the PACS system makes management so much easier, whether it is in our clinics, in MDTs or when I ring a colleague in a different hospital and we can both view images and discuss management.’

How does Sharron Dyce assess the new PACS from a management perspective? ‘We’ve installed a more complex, more robust system, with a primary PACS store and a backup PACS store; she said. ‘We’ve now got a global worklist which is also a data base and a vendor-neutral archive which is the central storage for the trust. Comparing the previous national contract to our managed service with Carestream, I think we’re probably paying 40% less than we were, so there’s massive savings there. And what of future developments? Sharron Dyce explained: ‘As a trust we went from transferring about 250 studies a week to importing about 180 a week and that will probably reduce to about 100 imports a week. That of course will allow image transfer teams to do other things than import studies from Cheshire and Merseyside, as they are now available on the global worklist.’

‘In order to bring other places on stream such as Wales and the Wirral, we’re looking at installing something called the Carestream Agent into sites that need to see Cheshire and Merseyside images and where we need to see their images, so that will be another step forward in data sharing. There’s also a zero footprint client viewer called Carestream Vue Motion which is a very simple viewer which will be the next step. Once we’ve got the global worklist available on the Vue Motion client, that will be the first port of call for all clinicians. They’ll see the image, a report and, if they need any advanced viewing, they can launch the full client from within Vue Motion.”
The 1954 Beecher and Todd study
The first major investigation into modern anesthesia practice and mortality was conducted in the US in 1954. The study, by Henry K. Beecher and Donald P. Todd, covered almost 600,000 surgical patients at 10 university hospitals in the period 1948-1952. It found an anesthesia-related death rate of 64 per 100,000 procedures, which provoked considerable concern, as the population-adjusted incidence (33 per million inhabitants) was over twice that of polio at the time. As a result, anesthesia safety became identified as a public health challenge.

Other investigations followed, both in the US and Europe. Above all, these served to usher an era of professional (and eventually, official) attention to safety and enhanced training. However, the findings of these studies were not always uniform, and have led to considerable debate.

Mortality falls in subsequent years, but not everywhere
In 1965, a ten-year US evaluation by Harry Memery of about 115,000 anesthetic administrations found an incidence of deaths in surgery of 31.8 per 100,000, or just under half the level in the mid-1950s. In 1982, a landmark British effort (the so-called Lunn and Mushin study) found death rates of 10 in 100,000. However, researchers in continental Europe continued to report higher mortality rates. As recently as 1990, a study in Denmark (Pedersen, et al) found 55 in 100,000 patients (one in 1,800) dying during anesthesia. This was both higher than the levels in the US and Britain, and not significantly different from a French effort in 1978-1982 (Tiret, et al) which studied 198,103 patients and found a rate of 42 deaths per 100,000 (one in 2,387).

Difference in definitions, study methodology
Behind such inconsistency lay a major problem. None of the above figures were strictly comparable. In 2009, a review of research in the 1954-2007 period (Gobbo Braz et al) found wide variations between definitions for deaths where anesthesia was “the primary or a contributing cause,” as well as the timeframe for the perioperative period. The latter include “intraoperative only”, “intraoperative and recovery from anesthesia”, the first 12, 24 or 36 postoperative hours, and two, three or seven postoperative days. Furthermore, several studies excluded cardiac, obstetric and certain other surgeries. Differences in definition and methodology, the authors concluded, made it “impossible to detect trends in anesthesia safety.”

These observations were already implicit in a 2002 paper by Prof. Robert Lagasse of the Albert Einstein College of Medicine in New York, who was especially scathing about the comforting conclusions made by the IOM in 1999 (see above).

Using data from 20-plus studies in 1966-2000, Prof. Lagasse found that anesthesia-related mortality ranged from 1 in 1,388 anesthetics to 1 in 85,708, with anesthesia considered solely responsible for perioperative death ranging from 1 in 1,800 anesthetics to 1 in 200,200. Like the Gobbo Braz study published seven years later, Prof. Lagasse underlined that major methodological differences made it impossible to detect trends in anesthesia safety.

Efforts to qualify findings
Such caveats were by no means due to the fault of the researchers investigating anesthesia-related deaths. Many made painstaking efforts to qualify their findings. For example, the landmark British Lunn and Mushin study referred to above found that, compared to 10 deaths in 100,000 in the operating room, anesthesia “might have played a role” in another 59 of 100,000 deaths and the number rose to as much as 600 per 100,000 (one in 166), if measured within 6 days of surgery.

Conversely, some of the relatively high mortalities reported in other studies were reduced, if their context was localized to the operating room, or otherwise qualified. For example, the French 1978-1982 study (Tiret, et al) saw a mortality rate of 42 per 100,000 falling sharply to 12.6 per 100,000 (one per 7,924 anesthetics) if the cause of death was “totally attributable to anesthesia.”

In 1987, a follow-on British investigation (after the Lunn and Mushin study) also attempted to assess anesthesia and mortality in more detail. Known as “The National Con-
fidental Enquiry into Perioperative Deaths; it separated mortality based on whether it followed a single or multiple surgical process, and extended the incidence period to 30 days after surgery. This effort found anesthesia as the sole cause of death in just 1 in 185,000 cases and contributory in 70 in 100,000.

The situation was, however, reversed in certain cases. In the 1990 Danish study (Pedersen, et al), mortality rose sharply from 55 to 192 in 100,000 patients (one in 1,800) if deaths during the post-operative recovery period were taken into account. Similarly, in Holland, a case-controlled evaluation of 869,483 patients (Arbous et al) reported anesthesia-related deaths of 14 per 100,000 in December 2001. However, in comments at the start of their research three years previously, the authors had noted their ‘cases’ would include a 24-hour peri-operative period. This served to increase the overall death rate over 6-fold to 88 per 100,000, and it was the latter figure which was reported by the journal ‘Anaesthesiology’ in February 2005.

Like-for-like comparisons indicate mortality decline to early 1990s

Nevertheless, if the above variables are accounted for, death rates from anesthesia seem to have been on the decline, since the 1940s to the early 1990s, at least. In Britain, even at the upper limit of 600 deaths per 100,000 procedures after six days of surgery, the 1980s Lunn and Mushin findings were three times lower than those from a previous British study, in 1973, which found 1,900 deaths per 100,000 within 7 days of surgery (roughly the same post-operative period). In Denmark, a follow-on study by Pedersen in 1994, found mortality “attributable to anesthesia” at 40 per 100,000 (1 in 2,500), down from 55 four years previously.

Recent investigations renew concerns

The situation in the 1990s and 2000s is, however, more nuanced. In his 2002 paper, Prof. Robert Lagasse of New York’s Albert Einstein College of Medicine concluded that the anesthesia-related mortality rate was stable over the 1990s at approximately 1 death per 13,000 anesthetics. This was in direct opposition to the widely-cited observation by the US Institute of Medicine (IOM) in 1999, that mortality fell further from “2 deaths per 10,000 anesthetics” in the 1980s to about 1 death per 200,000 to 300,000 in the late 1990s.

Many of the above contradictions are confounded by several, more recent developments. Anesthesia-related deaths remain relatively rare events and lack sufficiently large sample sizes. In addition, there is no national surveillance system to monitor anesthesia mortality. Last but not least, anesthesia is now not only increasingly administered outside a hospital setting, but also used for diagnostic procedures rather than surgery. These were some of the factors underscored in another major effort in 2009 by a Columbia University-Centers for Disease Control (CDC) team, to evaluate more recent data.

The Columbia-CDC team used ICD-10 codes “to identify anesthesia-related deaths from the US multiple-cause-of-death data files for the years 1999-2005,” and found 2,211 anesthesia-related deaths for the period. Anesthesia complications were the underlying cause in 10.9% of deaths and a “contributing factor” in the much larger share that remained. Of total deaths, 867 (39%) were in hospitals, 348 (15%) in ambulatory settings, and the rest in nursing homes, long term care facilities, hospices and other places. As a result, “the mortality risk of anesthesia for surgical inpatients was 0.82 in 100,000,” while the death rate from complications associated with anesthesia/anesthetics was 1.1 per million population - a “97% reduction” compared to the Beecher and Todd report for the years 1948 to 1952.

In spite of this heavy artillery, the authors urged caution. Nearly 47% of the anesthesia-related deaths, they found, were due to overdosing and another 42.5% due to adverse effects. They also specifically highlighted the need for monitoring anesthesia administration practices, given its growing use “outside of the traditional operating room setting.”

The role of the anesthesiologist has generally been highlighted in European investigations. In Britain’s Lunn and Mushin study from the 1980s, the authors noted that the 1 in 1,700 deaths where anesthesia “might have played a role” were avoidable, and that this situation did not seem to have changed over three decades. The Danish study in 1994 (Pedersen), found that one-third of the deaths attributable to anesthesia (1 per 2,500) were “preventable.”

Growth of elderly in surgery, new risks

It is clearly going to be some time before the dust settles on the sometimes contradictory findings about anesthesia and mortality. However, one factor about which there is widespread agreement is the increasing presence of the elderly in surgery, compared to the 1940s, and the higher risks of anesthesia in this population group.

In Denmark, the 1994 Pedersen study found that the bulk of deaths associated with anesthesia occurred in the elderly. In 1999, the French Society of Anesthesia and Intensive Care estimated that the number of anesthetic procedures had risen by 120% in the 1980-1996 period, with “a marked growth” among the elderly (75 years in age, or more).

In 2001, the Association of Anesthetists of Great Britain and Ireland published guidelines which sought to cope with challenges accompanying surgical procedures on the elderly. A new version is currently under preparation. Such concerns have also been echoed by ‘Deutsches Arzteblatt’, the journal of the German Medical Association. The article, published in 2011, said that among over-65s, the death rate from anesthesia-related causes, within a year of surgery, was as high as one in 10.

Dr. André Gottschalk, the study’s author, however, noted that the rise in anesthesia-related deaths worldwide was not due to a decrease in the quality of care but because of the rise in surgery on increasingly older patients.

The rise in anesthesia-related deaths worldwide is a consequence of the increasing presence of the elderly in surgery.
New frontiers in anesthesiology

Anesthesiologists face a daunting task keeping up and adapting their practice to cope with the incessant advances in surgery, and to innovations within their own discipline.

Today’s operating room patient profile has changed significantly, with the elderly accounting for a growing share of surgeries. This poses very specific new challenges. In addition, technological advancements have not only increased surgical interventions to younger children and infants, but dramatically intensified the scope and challenge of anesthetic procedures in ICU and critical care settings.

New anesthetic agents and procedures

First of all, innovations within the field of anesthesia have been significant and impacted upon its practice. Key developments over the past two decades include mandatory use of a recovery room to prevent hypoxia risks, perioperative monitoring (FiO2, SpO2, capnography, halogenated agents, neuromuscular transmission monitoring etc.). These have been accompanied by new anesthetic agents (and, in some cases, combinations); many clinical trials are currently making further evaluations. The aim is to offer more predictability, fewer side effects, and growing attention to the potential for anesthesia to positively influence perioperative outcomes.

Intensive and critical care: the historical connection with anesthesiology

Anaesthesiologists possess specific qualifications for ICU/critical care due to their expertise in clinical physiology and pharmacology as well as in emergencies, such as airway management, cardiac and pulmonary resuscitation and pain control.

Indeed, the birth of intensive care medicine is now attributed to a Danish anesthesiologist, Bjorn Ibsen, who left an operating theatre in December 1953 in order to use his skills on a 12-year-old girl suffering from polio. Another European anesthesiologist, Peter Safar, is credited with inventing cardiopulmonary cerebral resuscitation and providing the US with its first physician-staffed ICU.

The convergence between anesthesia and critical care is likely to strengthen in the years to come, not least due to the growing practice of merging the two departments at some of the world’s top-tier university hospitals.

Pain management and anesthesiology

Such departmental extension often also encompasses pain management, which lies at the historical roots of anaesthesiology. The American Society of Anaesthesiologists underlines that they are “uniquely qualified to prescribe and administer drug therapies or perform special techniques for acute, chronic and cancer pain.” In Britain, qualifying as a Fellow of the Royal College of Anaesthetists requires “an extensive knowledge of pain management” for both primary and final examinations.

The role of anesthesiologists is now extending to sometimes contentious issues in terminally ill patients. For example, at Germany’s Klinikum St. Georg Leipzig, a team of anesthesiologists is leading a study into whether palliative care offers a better option than assisted suicide.

The ICU: Frontline for anesthesia

In the ICU, propofol has been an anesthetic agent of choice for a time period of up to 72 hours and midazolam for long-term sedation. Intravenous (IV) anesthesia, nevertheless, has been widely associated with insufficient sedation quality, the growth of tolerance, respiratory depression, gastrointestinal paralysis, and withdrawal symptoms such as cognitive deficits (especially in the elderly). Concomitant analgesic use is also often required for pain relief in ICU patients, which tends to prolong awakening and increases respiratory depression.

Inhalative anesthetics seem to offer a better balance in terms of key criteria, such as low toxicity and side-effects, a short duration of action, predictable wake-up times and hemodynamic stability. However, their use in the ICU was restricted until the introduction in 2005 of the AnaConDa (Anesthetic Conserving Device or ACD), a heat-moisture filter system.

Inhalation versus IV anesthesia

There is presently a growing level of interest in assessing inhalative anesthetics in the ICU via ACDs, although efforts to date have been on small patient populations (e.g. with isoflurane in 2004, and sevoflurane in 2008).
Meanwhile, results of Phase II trials on a new short-acting IV candidate agent, remimazolam, are due to be announced in Germany in the first half of 2014. The GABA (A) receptor agonist is being compared in cardiac surgery patients against both propofol and sevoflurane. The trial is underway at the Heart Centre Leipzig, known for its ‘fast track’ approach in anesthesia, to wean patients from mechanical ventilation within six hours after surgery.

Another intravenous anesthetic, dexmedetomidine, has also been investigated for the ICU. Though relatively rare in its capacity to avoid respiratory depression, it has so far been approved only for short-term use. It is also expensive, although costs are expected to fall after its recent loss of patent cover.

Anesthesia and the elderly

Most of the above efforts to assess new anesthetic agents in the ICU involve the elderly, as part of an age cohort, typically from 18 to 80 years in age. This is to be expected as the elderly require relatively more intensive care than younger patients.

One ICU trial, however, is focused wholly on the 60-85 age group and involves remifentanil in patients undergoing coronary artery bypass. Another, in China, is evaluating dexmedetomidine to reduce postoperative delirium in the elderly, a specific problem in the age group with an incidence as high as 20%.

In general, the elderly require reduced doses of both inhalation and IV agents. In the former, the slower rate of induction is due to increased ventilation. The challenge for anesthetists is to ensure that the dose is not increased to hasten induction. It is also generally believed that “inhalation agents cause a larger decrease in blood pressure, at a given concentration of volatile agent” in the elderly, than in younger patients.

With IV agents, the lower dose requirement for the elderly is believed to ensue from a quicker build up of plasma concentration. As in the ICU, propofol is generally associated with decreased maintenance requirements and “less mental impairment”, compared to other agents. This is likely to become a powerful argument, after a 2013 French study reported that general anesthesia increases dementia risks in the elderly by as much as 35%.

Notwithstanding the advantages of propofol in the elderly, there is also considerable attention to whether IV is better than inhalative anesthetics, especially in terms of cognitive impairment.

Some (small) studies have indicated inhalatives carry a higher risk. More definitive answers are expected from a five-year study of 200 patients at Duke University in the US, comparing the cognitive effects of inhalative isoflurane against propofol; it was completed at the end of 2013 and is due to publish its results.

Researchers at the University of Toronto are assessing the relative benefits of spinal anesthesia (bupivacaine) versus general anesthesia using IV propofol, followed by maintenance with inhalative isoflurane or sevoflurane. This study, on 500 patients aged 70 and over, is targeted for completion in 2015 and will evaluate the two methods in terms of the onset of both dementia and Alzheimer’s.

Palliative care

Some new ICU agents are also candidates for palliative care. An investigator-initiated investigational new drug (IND) was recently approved in the US to examine the use of dexmedetomidine in treating cancer patients at the end of life.

This area is also the focus for wider attention by anesthesiologists, who as mentioned, are closely involved in discussions in Germany about assisted suicide. In the US, meanwhile, there is an intense debate on the legal implications of offering anesthesia to dying patients before withdrawal of ventilator support.
The challenge of pediatric patients

One of the most challenging frontiers for anaesthesia is in pediatric patients, where scores of trials over the past decade have sought to establish best practices. In 1983, anaesthesia in children was revolutionized after the arrival of the supraglottic laryngeal mask airway (LMA), which facilitated placement and hands-free maintenance. Until then, the use of endotracheal tubes were often accompanied by complications such as airway obstruction and aspiration of gastric contents. There has been a spare of innovations in this area in recent years, many of which have been tested initially in adults and are being targeted at pediatric use. Examples include:

- i-gel™, from Britain’s Intersurgical Ltd., a supraglottic airway device with a non-inflatable cuff and the option to introduce a gastric catheter
- air-Q ILA™, a self-presurized device with a self-adjusting cuff lacking a pilot balloon, distributed by Mercury Medical in the US
- Baska, a third-generation mask from Australia with an expandable, membranous cuff for sealing.

However, several questions remain unanswered in the field of pediatric anesthesia. One is the impact on language and cognitive function, especially in children below the age of 3 exposed to general anesthesia. The choice here is stark. Most anesthetic drugs seem to “cause long-term neurological impairment,” although the lack of anesthesia or analgesics seems to trigger neuro-apoptosis, so far in juvenile mammalian models. Further research on this subject was sought by the FDA in the US in 2007. Researchers are now seeking to clarify the comparative advantages of IV versus inhalative agents in terms of neuroprotection, where - once again - only animal or in vitro studies have so far been done.

Another priority area, again marked by a paucity of data, is delirium in pediatric patients, especially in ICUs. Various estimates put the incidence at between 5% and 17%.

The APRICOT Trial

Answers to at least some of these questions are hopefully going to come after completion of a major investigation in Europe. The European Society of Anesthesiology is due to launch a trial called APRICOT (Anaesthesia PRactice In Children Observational Trial), which aims to establish the incidence of severe critical events in children undergoing anesthesia, describe differences in practices across Europe and study the impact of such variability on the occurrence of events, among them laryngospasm, bronchospasm, anaphylaxis, cardiovascular instability, neurological damage, cardiac arrest and post-extubation stridor.
Sidestream Capnography, which provides vital information about CO₂ production, is widely applied in conscious sedation, ICU, anesthesia, and post-surgery recovery, etc. During the monitoring, a dehumidification device is always required. There are now two types of dehumidification designs on the market. One is the dehumidification tube, the other is the dehumidification cup.

The hydrophilic and hydrophobic elements inside makes the dehumidification tube high-cost and requires regular replacement due to limited water storage capacity. Compared to it, the dehumidification cup works much longer with even lower unit cost. However, the cup design still faces two frequent technical problems. One is drainage failure, which leads to air chamber damage; the other is false readings on lower sampling rate.

To solve such problems, EDAN introduced its new sidestream G2 CO₂ with a brand new dehumidification cup design.

1. Dual-channel Pumping
   With one channel connecting the air chamber, the second channel serves only for water drainage into the reservoir. Such design eliminates drainage failure and protects the module from water droplets.

2. Arc Dehumidification Channel
   A thin arc style dehumidification channel is introduced to this new dehumidification cup. Such design effectively reduced the dead spaces and improves the drainage capability.

3. One-way Channel Design
   In order to achieve a lower sampling rate, some dehumidification cups introduce a tee valve to control the flow rate. However, the switch itself will cause the air fluctuation and affect the measurement. On EDAN’s dehumidification cup, instead of a tee valve, a one-way structure design is employed on the second channel. It prevents the air backflow on inspiration and eliminates the affections of the tee valve. With the support of these technologies, together with the help of EDAN’s iCARB™ algorithm, EDAN G2 CO₂ is able to ensure accurate readings on either a lower sampling rate (70~100 ml/min) or a higher respiration rate (above 60 bpm). The advanced dehumidification cup design not only extends the life of the module, but also enhances the measurement fidelity.
Regional anesthesia and ultrasound-guidance

Among various techniques of regional anesthesia, peripheral nerve blocks (PNB) consist in anesthetizing only one single limb or one specific anatomical area. A huge body of scientific evidence now demonstrates that PNBs are of major interest during perioperative patient care in many surgical specialties. As a matter of fact, PNBs are even frequently superior to general anesthesia. The most important benefits of PNBs are found in outpatient surgery (1), in orthopedic surgery (2), but also in improving the overall quality of postoperative analgesia (3), at rest but especially during mobilization (i.e. long lasting blocks, perineural catheters).

However, the PNB techniques require expertise and technical skills, since it is necessary to inject the local anesthetic in close vicinity of nerve trunks or nerve roots in order to interrupt the nerve impulses.

The overall safety of these techniques requires mastering all potential complications, which, although exceptional, can be major when they occur (i.e. nerve lesion, seizure, cardiac arrest, to name only the most serious). These complications may be caused either by a mechanical trauma (nerve damage by the needle), or by toxicity of the administered local anesthetic (all local anesthetics show neurological toxicity, and some also cardiac toxicity). To summarize, safety in regional anesthesia requires the ability to avoid injecting local anesthetic intraneurally as well as intravascularly, and in reducing the injected doses.

Historically speaking, PNBs were initially performed using a blind technique (seeking paresthesias), then more recently using nerve stimulation, and since now a decade by using ultrasound guidance (USG).

Ultrasound-guided regional anesthesia (USGRA) has allowed reaching the safety standards and reducing complications as never before (4). When using US-guidance the anesthesiologist is able to identify the various anatomical structures and thus adapt the procedure to individual anatomy. Furthermore, US-guidance allows real-time needle guidance and assessment of local anesthetic spread around neural structures. Visualizing the spread of local anesthetic allows a rapid and early diagnosis of intravascular or intraneural injection too. There is now also scientific evidence that US-guidance decreases the number of vascular punctures, as well as reduces the injected volumes of local anesthetics, while increasing the overall success rate of PNBs. Moreover, USGRA improves the patient comfort (5).

Ultrasonography is now part of the everyday tools for the anesthesiologist. This bedside technology is useful not only for regional anesthesia, but also for placing peripheral and central venous access with a reduced risk of complications, for bedside assessment of gastric emptiness before the induction of a general anesthesia, or for an early assessment of severe trauma patients (i.e. FAST protocols) (6). Ultrasonography is also a major tool in intensive care units (i.e. cardiac and thoracic ultrasonography). Putting all this together, it is no longer possible to imagine working as an anesthesiologist without having an immediate access to bedside high quality ultrasonography.

Ultrasound devices designed for the operating theatre must provide high quality of images, as well as the usual US modes (i.e. B, PW, CFM, …), and at least two probes (linear high frequency and convex low frequency), but in a small and compact size with sufficient battery life, enabling the ultrasound systems to be mobile, lightweight, and easily usable in the operating theatre environment.

Nowadays, several devices of this kind are on the market from different companies. Among these, the French company ECM Echo Control Medical manufactures high quality portable ultrasound imaging systems meeting the necessary technical specifications and European manufacturing standards. The ECM devices also have an excellent cost/quality ratio. Indeed, to meet the increasing needs for ultrasound in the operating theatres, the devices must still provide efficient and high quality images, but their cost should remain affordable to be compatible with the budget for equipment. The ECM Exago and Exagyne systems live up to these challenges and moreover follow the latest evolutions of the ultrasound market with regular updates adapted to the needs of the anesthesiologists.

References

Siemens wins major healthcare IT contract
Siemens’ Healthcare Sector has won contracts from two Dutch university hospitals, the Erasmus University Medical Center Rotterdam (Erasmus MC) and University Medical Center Groningen (UMCG), to supply, implement, and support the Soarian Clinicals hospital information system, including electronic patient record (EPR).

With a combined value of more than €50 million, the contract represents one of the largest Healthcare IT contracts awarded to Siemens to date. The contracts for both hospitals have a term of ten years. Work on installation is planned to start as early as April 2014, and the project should be in regular clinical operation by end of 2015.

Both customers awarded their contracts simultaneously, as a means of cooperating even more closely using the new software solution.

The hospital information system is used to make available patient data, along with imaging, laboratory diagnosis and treatment-related data, on a software platform. Soarian Clinicals enables the hospital staff to have comprehensive access to the latest relevant patient data within the confines of the data protection regulations. The software allows clinical processes to be mapped, optimized and organized paperlessly, helping to make them more transparent as well as faster and more efficient.

Each hospital has about 1,300 beds and employs about 11,000 staff.

www.siemens.com/healthcare

Maquet and Pulsion announce cooperation in advanced monitoring

As part of Maquet Critical Care’s goal to build a portfolio of advanced monitoring products, Maquet and Pulsion announce a collaboration to distribute the EIRUS continuous glucose and lactate monitoring - in Germany, Poland, Spain, France, Austria, Switzerland and UK.

“We are really excited about this product and believe that Pulsion’s experienced sales organization will increase the pace of bringing this technology to the market, supporting our strategic efforts within advanced monitoring solutions,” commented Jens Viebke, President, Maquet Critical Care.

www.maquet.com

ZNA hospital group in Belgium extends Agfa HealthCare’s ICIS to integrate all medical images onto single cloud-based platform

The ZNA hospital network of Antwerp, Belgium, is extending its existing Agfa HealthCare ICIS imaging platform beyond radiology. With the deployment, all other image-producing departments of the hospital group will be integrated, whether they produce DICOM or non-DICOM images. In addition, patient images from other facilities can be quickly and easily imported as well. The ICIS VIEW zero footprint image viewer will be implemented for internal and external image distribution, for all types of medical images.

With nine sites in the Antwerp area, ZNA is not only among Belgium’s leading hospital groups, but is also one of Europe’s top 10 care organizations. The group services some 44% of the Antwerp region’s one million inhabitants, with a combined total number of 2,500 beds and 7,000 healthcare professionals. Each year, the group performs more than 1 million consultations, lab and imaging exams and treats 75,000 in-patients.

ZNA has run IMPAX PACS on a software as a service (SaaS) basis since 2010. It is the first hospital in Belgium to implement the ICIS VNA platform; all image archiving and storage is handled off-site, at Agfa HealthCare’s data centre in Mortsel. Currently the hospital stores 33 TB in the ICIS VNA, the equivalent of 1.2 million studies. The hospital network decided to extend its ICIS VNA platform into an enterprise-wide solution. The workflow already integrates images from radiology and nuclear medicine. Now, DICOM and non-DICOM images from other departments will also be included, as well as images brought by patients from other sites, using e.g. CDs. The goal is to archive all medical images from different departments into a single platform, and to integrate the images in the electronic medical record (EMR).

As part of this, ZNA is also deploying a new EMR system. The result will be a complete and comprehensive view on patient data within the EMR. The roll-out of the ICIS enterprise imaging platform and the EMR are being coordinated to achieve this goal.

With the ICIS VIEW zero-download image viewer, caregivers inside or outside the hospital will have on-demand image and report access, within the context of ZNA’s patient and GP portal, Sara-i, and its regional integration via the COZO platform. Sara-i provides external users with secure access to reports and images, while COZO is a collaborative platform allowing healthcare providers to share health information, including images.

www.AgfaHealthCare.com

Philips launches new Healthcare Informatics Solutions and Services business group

Since late January, Healthcare Informatics Solutions and Services is a new business group within Philips’ Healthcare sector that offers hospitals and health systems the customized clinical programs, advanced data analytics and interoperable, cloud-based platforms necessary to implement new models of care.

Building off a proven track record in improving the health of aging and at-risk populations, Healthcare Informatics Solutions and Services will partner with healthcare providers to improve access, lower cost and enhance quality across the continuum of care, from screening and diagnosis, to treatment and monitoring, and finally after care at home.

“Healthcare systems today are changing the way they operate, how decisions are made and how patients receive care,” said Deborah DiSanzo, chief executive officer, Philips Healthcare. “This requires a significant overhaul of complex organizations, as well as the associated actionable data about each patient population they serve. As we continue to expand the tools, analytics, consulting and support, we are paving the way for providers to transition into more integrated, collaborative care.”

Healthcare Informatics Solutions and Services will be led by Jeroen Tas, who previously served as the chief information officer of Philips, and will represent the next step in the evolution of Philips, responding to increasing demand by major health systems worldwide.

www.philips.com
Interdisciplinary cooperation between radiology and surgery: what can International Hospital (or the media generally) do to make this possible?

The origin of disciplines
If neither the knife nor the X-ray machine had been invented, there would be no disciplines of surgery or radiology as we understand them today. In short, tools themselves can lead to the creation of complex disciplines, be they medical or otherwise.

Many scientific and medical disciplines are, in principle, defined by tools or tool sets and the ability of certain humans to use them effectively and efficiently. Tools may be material artefacts or tools of thought and may indirectly lead to ethnocentric thinking and mesa-communication.

For example in the case of Surgery, tool sets, such as knives and saws, and the art of using them, were developed over thousands of years by those devoted to healing. In modern times, the disciplines which were originally associated with these basic tools have evolved into a multitude of different surgical and interventional sub-specialties, each with its own refined set of tools and instruments.

A similar situation can be observed for the discipline of Radiology. Since the discovery of the X-ray by Roentgen in 1895, radiology has evolved into a multitude of different diagnostic and therapeutic subspecialties that may be identified by their specialized sets of imaging tools and devices.

Finally, the discipline of Computer Science or informatics has managed over a period of only about 70-80 years to factor itself into some 40 specialities; a few of them are hardware tools but most are software tool-oriented.

It is interesting to note that some tool sets of these disciplines are in the process of being merged towards potentially creating a specialty defined as “image guided intervention”. Not before long, this will evolve into an “information guided intervention”, where not only the image but all available information of the patient will be used for guidance.

This raises an important question: When two or more tool sets are merging, for example in a healthcare setting that is expected to provide optimal care for the patient, should the professions which traditionally handled the two or more tool sets also merge, thereby potentially creating a new discipline?

Logically, probably yes! Practically, this is not as easy as it may appear; it may even be impossible.

Interdisciplinarity
After actively attending radiological and surgical congresses/gatherings for many years and also working in a hospital environment as a researcher, I see few signs and little evidence in each discipline of seeking interdisciplinary cooperation with the other ones. If this observation is correct, there must be a reason for this phenomenon. It probably requires an anthropological explanation, preferably provided by structural anthropology which, in principle, is based on Claude Lévi-Strauss’ idea that immutable deep structures exist in all cultures.

Lévi-Strauss showed, for example, how opposing ideas would fight each other and also be resolved in the rules of marriage, in mythology, and in ritual. This approach, he felt, made for fresh new ideas [Wikipedia]. He stated:

“People think about the world in terms of binary opposites—such as high and low, inside and outside, person and animal, life and death—and that every culture can be understood in terms of these opposites. "From the very start," he wrote, “the process of visual perception makes use of binary oppositions." [Structuralism and Ecology, 1972]

The above type of thinking may give rise to:

1. Collective or group thinking (e.g. for professional recognition and security, political strength, and self-confidence).
2. Individual egoism (i.e. “What’s in it for me personally?”).
3. Partisan social or decision-making environments, (e.g. actors fulfilling group expectations and succumbing to group pressure).

In the context of radiology and surgery, possible solutions to resolve thinking in terms of “black and white” or “them and us” are:

1. Interdisciplinary (meta-)communication and meeting platforms (to build trust and increase understanding between different medical conventions and cultures).
2. Fuzzy method-based machine intelligence (with new tool sets and new groups or (inter-) disciplines for controlling them).
3. Increased patient empowerment (e.g. for questioning the existing health care structures and divisions).
4. Increase the awareness of all stakeholders in healthcare in relation to these problems (e.g. through peer- and non-peer reviewed publications in the healthcare media and beyond).

What can International Hospital (or the media generally) do to make this possible?

The first two points made above are very much the responsibility of the
disciplines in question, here radiology, surgery and informatics. The last two points, however, are more general and relate to providing an awareness producing forum by means of presenting viewpoints and encourage opinion exchange on interdisciplinary cooperation. In particular, for media such as International Hospital, it should be considered to solicit, encourage and publish articles and interviews on all aspects of:

a) general healthcare situations where interdisciplinary cooperation is a condition sine qua non, e.g. tumour boards, therapy planning units, etc.,

b) specific healthcare situations where interdisciplinary cooperation has been and is pursued for the benefit of the patient, e.g. between interventional radiology, cardiology and cardiac surgery,

c) specific healthcare situations where interdisciplinary cooperation has not been and is not being pursued for a variety of reasons, e.g. in some tumour boards,

d) specific patient experiences relating to successful and not so successful interdisciplinary cooperation and resulting outcomes,

e) general strategic, organizational and technical methods and tools which encourage interdisciplinary cooperation, e.g. quality function deployment, participative design, success resource deployment, etc. and

f) create or encourage an award/acknowledgement environment for achievements in interdisciplinary cooperation.

As information and communication technology and related tools evolve, the distinction between some of the medical specialities using them such as interventional radiology and minimally invasive surgery is likely to decrease or becomes less clear. For insiders and those practising with the given tools, this may not always be similarly perceived. Seen from the outside, however, this development should be taken into account and encouraged to be mapped into organizational healthcare infrastructures accordingly. Considering the power of the media, this would be an honourable task to pursue.

*Meso-communication takes place within groups as opposed to meta-communication which allows for communication between groups or cultures.

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In the context of the twin disciplines of radiology and surgery, there is still too much thinking in terms of “them and us” and not enough interdisciplinary cooperation.
Healthcare providers and social media

If the Internet and the Web were stepping stones to the Information Age at the end of the 20th century, social media seems to be opening the floodgates to the Connected World in the 21st.

Nearly everyone agrees that the impact of social media in the years to come is likely to be sweeping. A study by the University of California at San Diego found that rather than being a parallel world, Facebook is becoming an extension, even an “augmentation”, of the way we live and experience life.

Both opportunities and challenges

Most industries have already implemented or are developing a social media strategy; healthcare is no exception. However, for healthcare providers like hospitals and physicians, social media poses both specific challenges and opportunities.

Key social media channels used by hospitals include collaborative networks (Facebook and Twitter), video sharing channels (YouTube), professional networks (LinkedIn), physician blogs and thematic networks (PatientsLikeMe, TuDiabetes etc).

In the early years, hospitals which ventured into social media were dismissed by industry veterans as being irresponsible. Some first-movers, indeed, did pay a price. For example, the prestigious Mayo Clinic in the US was embarrassed when a paid advertisement for “cute little (children’s) dresses” cropped up adjoining an expert blog on coping with the loss of a pregnancy. The 120-year old institution, which started a Facebook fan page in 2007, was also one of the first hospitals to appoint a social-media manager. Other top-tier US hospitals, which were early adopters of social media technologies, include Johns Hopkins, Memorial Sloan-Kettering, Cleveland Clinic and Massachusetts General Hospital.

Privacy and liability

The challenges of social media in healthcare broadly concern privacy and liability. Social media can make it “easy to violate patient privacy, potentially exposing individuals and the organization to sanctions” such as those under the Health Insurance Portability and Accountability Act (HIPAA) in the US, or the EU’s Data Protection Directive 95/46/EC.

Ironically, the very features which make social media attractive (immediacy and interactivity) can erode user restraint in making statements which could damage the reputations of their organizations. Such damage is especially problematic, given the logarithmic growth in the dissemination of information accompanying social media; one of the best known examples of this consist of YouTube videos which go “viral”.

Issues of taste and sensitivity

Another closely associated challenge is that of sensitivity. Hospitals are in the business of providing healthcare, not electricity. Some of the greatest consumer concerns, which play out in social media, can involve life and death. In such cases, seemingly routine errors, for example those involving issues of timing and placement, can have major implications - as highlighted by the advertisement which accompanied the Mayo Clinic blog mentioned above.

The patient as consumer

On the other side, the opportunities are vast. “As consumers increasingly flock to social media for every aspect of their lives, including guidance about their health, healthcare providers and organizations can take advantage of new tools to reach consumers they may not otherwise have been able to communicate with,” or lose them to competitors.

And consumers have clearly begun shopping for healthcare, especially in the US. In the past, hospitals were perceived in terms of geography - “what’s closest and how fast” a patient could reach it. “Now that’s not an issue,” Ned Russell, managing director of Saatchi & Saatchi Wellness, told ‘Advertising Age’. Indeed, 25% of the patients at the Mayo Clinic come from distances of 500 miles (800 kilometres) or more.

In Europe, the role of patients in hospital choice is less pronounced. According to a report from Health Consumer Powerhouse, the vast majority of Europeans still decide on grounds “such as the traditional family GP or the hospital around the corner.” However “benchmarking of hospitals and doctors” has begun, especially in some countries, and is expected to demand more attention in the years to come.

Internal organizational benefits

Other opportunities too abound, beginning with the organization of a hospital itself. Several studies have reported that social media improves communication among staff, facilitates networking and is useful to recruit volunteers for research projects and clinical trials. For example, the thematic network, PatientsLikeMe, connects more than 140,000 patients with conditions like Parkinson’s and Lou Gehrig’s disease.

Social media has also proved useful in breaking down hierarchal boundaries
within hospitals by making top executives accessible to others. Some of its other advantages are down-to-earth and practical. Travelling physicians, for instance, are able to stay in touch with support staff via Twitter updates.

Data aggregation
Between such challenges and opportunities, what is now amply clear is that hospitals simply cannot ignore social media. As IT solutions provider CSC advises, even if a hospital does not have an active social media presence, its “employees and customers are already using social media and may be sharing information” about a hospital.”

Apart from providing open, dispersed and universal access, one of the greatest effects of social media is data aggregation. Patients, like consumers, tend to be influenced by perceptions and trends, and feed these further in a self-perpetuating cycle. In effect, social media shifts power, sometimes an inordinate amount of it, to a buyer.

The implications of this have begun to be felt by healthcare providers. Initiatives like Vitals.com and RateMDs.com in the US provide patients the chance to pick and choose physicians. Such aggregators of large-scale, anonymous opinions raise questions about reporting bias. So too do non-moderated blogs. However, their impact remains an area which healthcare providers simply cannot afford to ignore. In 2011, after a three-year ordeal, a US cosmetic surgeon finally won a $12 million defamation verdict against a former patient, who alleged that he had disfigured her face, and claimed wrongly on the Internet that he was not Board-certified and may be sharing information” about a hospital.”

The influence of social media trends is likely to strengthen with time. By 2011, a survey by YouGov in the US showed that 57% of consumers believed “social media connections would have a strong impact on their likelihood to seek treatment at the hospital.” The survey also found one fourth of consumers saying they were likely to connect with hospitals via social media in the future.

One of its key findings, however, was that 81% of consumers believed that a hospital with a strong social media presence was more likely to provide ‘cutting edge’ technology and therapies.

Europe, the US and healthcare social media lead
Most studies on these subjects have so far been in the US. However, social media is clearly going to play a major role in Europe too. Indeed, the Health Consumer Powerhouse report mentioned above, on hospital choice by patients, sought to convert its efforts into “a social media project” via interaction with consumers on its blog and Facebook.

One of the most comprehensive European efforts on this score is an Anglo-Dutch study published by the Journal of Medical Internet Research (JMIR) in May 2012. The authors, who investigated social media use by 873 hospitals in 12 European countries in the period 2009-2011, found a steady increase in use in all countries, especially Facebook (from 10% to 67.0%), Twitter (from 1% to 18%) and YouTube (from 2% to 19.7%).

The study, however, also observed significant differences in social media use within Europe. Twitter was especially popular in Britain, the Netherlands and Norway. YouTube was used by 35% of UK hospitals, 28% in the Netherlands and 23% in Sweden, but had zero use in Ireland and Finland. Belgium, too, had a low user base, of just 5%. Hospitals in most other countries showed YouTube penetration of about 15%. Facebook dominated social media in European hospitals, with a record 93% showing in Britain. Usage levels were close to 90% in Denmark, and Norway, approximately 80% in Austria, Finland and Ireland, 70% in Belgium and 40-50% in Sweden, Switzerland and Luxembourg. A surprisingly low level of Facebook use was reported by Dutch hospitals, at just 15%, although the authors note that this might have been due to the popularity of Hyves, a local social network in the Netherlands with over 11 million members.

An interesting claim in the JMIR review was that European hospitals used social media more than the US. The authors estimated that Facebook was used by just 20% of US hospitals, Twitter by 16% and YouTube by 11%. More recent US studies (in August 2013) estimate far higher levels - Facebook at 84%, Twitter at 64% and YouTube at 46%. Nevertheless, these numbers do not necessarily demonstrate a major gap in Europe, where usage levels are also likely to have continued growing in the 15 months which passed since publication of the Anglo-Dutch study.

Physician-only social media
In both Europe and the US, one of the areas of attention in the future is likely to be physician-only social networks. These were used by 22% of European physicians in 2012, up from 13% in 2011. However, as with hospitals, penetration levels again varied widely, from 48% in the UK to 7% in Italy; France and Spain were in between with 17%, and Germany with 28%.

Once again, the European average seems to be higher than in the US, where a survey found “about one in four physicians” using social media in 2012, with slightly over half saying they used physician-only networks.

The viral marketing concept can also result in damaging the reputation of an institution.
The 72nd China International Medical Equipment Fair (CMEF Autumn 2014)
The 19th International Component Manufacturing & Design Show (ICMD Autumn 2014)

Chongqing International Convention & Exhibition Center
Oct. 23-26, 2014

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A healthy dose of radiation monitoring

With the drive for dose reduction and improved dose registration gathering pace, Dr. Jamie Fraser, Dorrell Metcalfe and Susan Delaney of the Queen Elizabeth II Hospital in Halifax, Nova Scotia, explain how they worked with Agfa HealthCare on the development of the IMPAX REM.

As the largest teaching hospital and adult academic health sciences centre in Atlantic Canada, Capital District Health Authority, with its reputation as a centre of excellence in health research, was an obvious choice as a pilot site for Agfa HealthCare’s IMPAX REM solution. As providers of general hospital services for Halifax and the Central Health Region of Nova Scotia, Capital Health’s diverse patient base made it a good testing ground for tracking and collecting radiation exposure information.

Developing a national strategy for dose collection and registration

Dr Jamie Fraser, a professor at Dalhousie University and past President of the Canadian Association of Radiologists, explains, “I was initially involved with a REM project through the National Research Council (NARC) and the Canadian Association of Radiologists (CAR). We had been looking to develop a national strategy for dose collection and registering and had been discussing how best to get this going. Inevitably, other more urgent projects took priority and the project was put on hold, with the intention of revisiting it in the future. So, when Agfa HealthCare mentioned it was developing a software solution in this area and was looking for a test site, Capital Health seemed like a good choice from the point of view of size, multiple sites, and other factors – and it also seemed the perfect way to keep a REM initiative going.”

Susan Delaney, Director, Diagnostic Imaging Services Capital Health: “We try to be innovative when we can, and we have had a long history of collaboration with Agfa HealthCare on other projects, so the idea of being involved in the IMPAX REM pilot was a natural progression of that relationship. We already have a physicist on staff and quality control technologists who look at all aspects of the care and quality that we provide. A key part of their programme is to look at diagnostic reference levels for CT and for general imaging. They work hard to lower the dose from our CT scanners, optimizing protocols, working with radiologists to ensure the image quality is certainly diagnostic but with as low a dose as possible. This initiative fits in with our own strategy of constantly looking at what we are doing to see if we can do things better.”

The IMPAX REM pilot project began in the summer of 2012. It ran for 12 months, with the usability testing stage lasting 12 weeks, as Dorrell Metcalfe, Diagnostic Imaging Information Services Coordinator explains, “Once we had seen version 1.0 of IMPAX REM, we recognized that it certainly had merit. The same physician responsible for our quality control was part of the team who became heavily involved in the Agfa HealthCare pilot project, in terms of looking at quality control, modelling tools and dose analysis.

“When it first arrived, IMPAX REM was a functional product but in its early stages of development. During our close collaboration, working with Agfa HealthCare over the year and having the close ear of the key stakeholders, we saw it develop rapidly.”

IMPAX REM fits in with our philosophy regarding dose reduction aims

Susan says, “Normally if we were going to buy software we would have to go out to tender. This was a unique opportunity for us to have the information ahead of the curve. By continuing with it past the initial testing phase, we are able to continue to expand our knowledge and, from a patient benefit perspective, to highlight to our physicians that no exams should be ordered unless they have done a risk benefit analysis.”

“The dose reduction issue is something that has been on our radar for a number of years, so it fits in with our philosophy of being as careful as we can with regard to the dose for our patients. IMPAX REM gives us more information and keeps us aware of how radiation exposures affect patients and how we can reduce dose.”

Trials enable us to gain more insight and do research around dose reduction

Jamie adds, “Over the last few years, there has been a campaign of awareness to educate both patients and radiologists with regard to radiation dose. The big advantage of a project like this is that although there is a lot we don’t know about radiation dose, trials enable us to gain more insight and do research around it. Once you have more data, you can realize what it is that is important in terms of the diagnostic quality vs the radiation dose. Although this work is being done at a local level, we would hope that in time it will expand to national level so that we can really look at radiation dose and get the bigger picture.

“The Canadian Association of Radiologists is encouraging all the provinces to get on board with projects like this, so that in the long-term we can have a whole network of these projects to feed into a national database.”

IMPAK REM

- Collect
- Track
- Analyze
ASGE issues guidelines for safety in the gastrointestinal endoscopy unit

The American Society for Gastrointestinal Endoscopy (ASGE) has issued “Guidelines for safety in the gastrointestinal endoscopy unit.” The purpose of this new guideline is to present recommendations for endoscopy units in implementing and prioritizing safety efforts and to provide an endoscopy-specific guideline by which to evaluate endoscopy units. The guideline is published on the website of GIE: Gastrointestinal Endoscopy, the monthly peer-reviewed scientific journal of ASGE, at www.giejournal.org.

Historically, safety in the gastrointestinal (GI) endoscopy unit has focused on infection control, particularly around the reprocessing of endoscopes. Although ASGE has previously published guidelines on staffing, sedation, infection control, and endoscope reprocessing for endoscopic procedures, rare reports of outbreaks in which the transmission of infectious agents were related to GI endoscopy have highlighted the need to address potential areas in the endoscopy care continuum that could impact patient safety.

Changes to the Centers for Medicare and Medicaid Services (CMS) Ambulatory Surgical Center Conditions for Coverage that went into effect in 2009 eliminated the distinction between a sterile surgical room and a non-sterile procedure room, providing further impetus for this guideline. As a result of these conditions, non-sterile procedure environments, including endoscopy units, are now held to the same standards as sterile operating rooms even though requirements for facilities, infection control, staffing, and sedation applicable to the sterile operating room may not be relevant or necessary for endoscopy units. To date, the Association of Perioperative Registered Nurses and other organizations have set standards for sterile operating environments. ASGE’s new guideline is endorsed by organizations with specific expertise in the safe delivery of care in the non-sterile, GI endoscopy environment, which recognize the important distinction between the endoscopy and sterile operating room settings.

“Over the past two years, surveyors have called into question accepted practices at many accredited endoscopy units seeking reaccreditation. Many of these issues relate to the Ambulatory Surgical Center Conditions for Coverage set forth by CMS and the lack of distinction between the sterile operating room and the endoscopy setting,” said Audrey H. Calderwood, MD, co-chair, ASGE Ensuring Safety in the Gastrointestinal Endoscopy Unit Task Force. “ASGE recognized a need to develop nationally-recognized guidelines for endoscopy units that provide recommendations for the implementation and prioritization of safety efforts within GI endoscopy. These endoscopy-specific guidelines will also serve as an important resource for surveyors tasked with evaluating endoscopy units.”

ASGE
http://tinyurl.com/kes7at8

Amputee feels in real-time with bionic hand

Nine years after an accident caused the loss of his left hand, Dennis Aabo Sørensen from Denmark became the first amputee in the world to feel – in real-time – with a sensory-enhanced prosthetic hand that was surgically wired to nerves in his upper arm. Sørensen could grasp objects intuitively and identify what he was touching while blindfolded.

Silvestro Micera and his team at EPFL Center for Neuroprosthetics and SSSA (Italy) developed the revolutionary sensory feedback that allowed Sørensen to feel again while handling objects. A prototype of this bionic technology was tested in February 2013 during a clinical trial in Rome under the supervision of Paolo Maria Rossi at Gemelli Hospital (Italy). “The sensory feedback was incredible,” reports the 36 year-old amputee from Denmark. “I could feel things that I hadn’t been able to feel in over nine years.” In a laboratory setting wearing a blindfold and earplugs, Sørensen was able to detect how strongly he was grasping, as well as the shape and consistency of different objects he picked up with his prosthetic. “When I held an object, I could feel if it was soft or hard, round or square.” Micera and his team enhanced the artificial hand with sensors that detect information about touch. This was done by measuring the tension in artificial tendons that control finger movement and turning this measurement into an electrical current. But this electrical signal is too coarse to be understood by the nervous system. Using computer algorithms, the scientists transformed the electrical signal into an impulse that sensory nerves can interpret. The sense of touch was achieved by sending the digitally refined signal through wires into four electrodes that were surgically implanted into what remains of Sørensen's upper arm nerves.

“This is the first time in neuroprosthetics that sensory feedback has been restored and used by an amputee in real-time to control an artificial limb,” says Micera. “We were worried about reduced sensitivity in Dennis’ nerves since they hadn’t been used in over nine years,” says Stanisa Raspopovic, first author and scientist at EPFL and SSSA. These concerns faded away as the scientists successfully reactivated Sørensen’s sense of touch.

EPFL
http://tinyurl.com/lbq6wr

UCLA researchers’ smartphone ‘microscope’ can detect a single virus, nanoparticles

Your smartphone now can see what the naked eye cannot: A single virus and bits of material less than one-thousandth of the width of a human hair.

Aydogan Ozcan, a professor of electrical engineering and bioengineering at the UCLA Henry Samueli School of Engineering and Applied Science, and his team have created a portable smartphone attachment that can be used to perform sophisticated field testing to detect viruses and bacteria without the need for bulky and expensive microscopes and lab equipment. The device weighs less than half a pound.

“This cellphone-based imaging platform could be used for specific and sensitive detection of sub-wavelength objects, including bacteria and viruses and therefore could enable the practice of nanotechnology and biomedical testing in field settings and even in remote and resource-limited environments,” Ozcan said. “These results also constitute the first time that single nanoparticles and viruses have been detected using a cellphone-based, field-portable imaging system.”

The new research comes on the heels of Ozcan’s other recent inventions, including a cellphone camera–enabled sensor for allergens in food products and a smart phone attachment that can conduct common kidney tests. Capturing clear images of objects as tiny as a single virus or a nanoparticle is difficult because the optical signal strength...
Brain connectivity study reveals striking differences between men and women

A new brain connectivity study from Penn Medicine found striking differences in the neural wiring of men and women that’s lending credence to some commonly-held beliefs about their behaviour.

In one of the largest studies looking at the “connectomes” of the sexes, Ragini Verma, PhD, an associate professor in the department of Radiology at the Perelman School of Medicine at the University of Pennsylvania, and colleagues found greater neural connectivity from front to back and within one hemisphere in males, suggesting their brains are structured to facilitate connectivity between perception and co-ordinated action. In contrast, in females, the wiring goes between the left and right hemispheres, suggesting that they facilitate communication between the analytical and intuition.

“These maps show us a stark difference—and complementarity—in the architecture of the human brain that helps provide a potential neural basis as to why men excel at certain tasks, and women at others,” said Verma.

For instance, on average, men are more likely better at learning and performing a single task at hand, like cycling or navigating directions, whereas women have superior memory and social cognition skills, making them more equipped for multitasking and creating solutions that work for a group. They have a mentalistic approach, so to speak.

Past studies have shown sex differences in the brain, but the neural wiring connecting regions across the whole brain that have been tied to such cognitive skills has never been fully shown in a large population.

Pennsylvania Health System
http://tinyurl.com/mdzkceh

Menstrual cycle influences concussion outcomes

How well a woman recovers from a concussion may depend on that time of the month.

Researchers found that women injured during the two weeks leading up to their period (the pre-menstrual phase) had a slower recovery and poorer health one month after injury compared to women injured during the two weeks directly after their period or women taking birth control pills.

If confirmed in subsequent research, the findings could alter the treatment and prognosis of women who suffer head injuries from sports, falls, car accidents or combat.

Several recent studies have confirmed what women and their physicians anecdotally have known for years: Women experience greater cognitive decline, poorer reaction times, more headaches, extended periods of depression, longer hospital stays and delayed return-to-work compared to men following head injury.

Such results are particularly pronounced in women of childbearing age; girls who have not started their period and post-menopausal women have outcomes similar to men.

Few studies have explored why such differences occur, but senior author Jeffrey J. Bazarian, M.D., M.P.H. says it stands to reason that sex hormones such as estrogen and progesterone, which are highest in women of childbearing age, may play a role.

“I don’t think doctors consider menstrual history when evaluating a patient after a concussion, but maybe we should,” noted Bazarian, associate professor of Emergency Medicine at the University of Rochester School of Medicine and Dentistry who treats patients and conducts research on traumatic brain injury and long-term outcomes among athletes. “By taking into account the stage of their cycle at the time of injury we could better identify patients who might need more aggressive monitoring or treatment. It would also allow us to counsel women that they’re more—or less—likely to feel poorly because of their menstrual phase.”

Although media coverage tends to focus on concussions in male professional athletes, studies suggest that women have a higher incidence of head injuries than men playing sports with similar rules, such as ice hockey, soccer and basketball.

Bazarian estimates that 70 percent of the patients he treats in the URMC Sport Concussion Clinic are young women. He believes the number is so high because they often need more follow-up care. In his experience, soccer is the most common sport leading to head injuries in women, but lacrosse, field hockey, cheerleading, volleyball and basketball can lead to injuries as well.

Sex hormone levels often change after a head injury, as women who have suffered a concussion and subsequently missed one or more periods can attest. According to Kathleen M. Hoeger, M.D., M.P.H., study co-author and professor of Obstetrics and Gynecology at the University of Rochester School of Medicine and Dentistry, any stressful event, like a hit to the head, can shut down the pituitary gland in the brain, which is the body’s hormone generator.

If the pituitary doesn’t work, the level of estrogen and progesterone would drop quickly.

According to Bazarian, progesterone is known to have a calming effect on the brain and on mood. Knowing this, his team came up with the “withdrawal hypothesis”: If a woman suffers a concussion in the pre-menstrual phase when progesterone levels are naturally high, an abrupt drop in progesterone after injury produces a kind of withdrawal which either contributes to or worsens post-concussive symptoms like headache, nausea, dizziness and trouble concentrating. This may be why women recover differently than men, who have low pre-injury levels of the hormone.

University of Rochester Medical Center
http://tinyurl.com/luvwjp4
FRONT COVER PRODUCT

Mechanical chest compression device

Performing manual chest compressions adequately for an extended period of time is almost impossible. Not only is it physically demanding, but other actions are also required simultaneously, such as vital signs monitoring. As the smallest mechanical chest compression device, the Easy Pulse provides a solution for more effective resuscitation. This portable, standalone device delivers chest compressions automatically at a consistent rate and depth. It is directly attached to the patient’s upper body and can thus be used in any situation, regardless of ambient conditions. The Easy Pulse can be operated by a single person – whether paramedics or lay rescuers. Its size and weight are unparalleled as it weighs less than 3.5 kg, opening up entirely new possibilities e.g. for air rescue services. The device allows multidirectional chest compressions and offers the possibility of performing a 30:2 compression – ventilation cycle. Thanks to the slider and buckle system, a single person can easily attach the device which is easy to position and easy to operate: pressing a button twice is enough to initiate resuscitation immediately.

SCHILLER

www.ihe-online.com & search 46581

Operating theatre device control system

Today’s operating theatres are simply brimming with the latest technology, and surgical staff has to know how to correctly work any number of medical devices whenever needed. Variations in how the various devices are controlled present just as big a challenge as the increasing sophistication of system functions. Delays and insufficient coordination in the operating theatre not only cost time and money, but can also compromise safety and increase stress. The TruConnect control and training system centralizes information and device control. It enables both mobile and stationary control of a variety of Trumpf operating theatre components, offering convenient, handheld and touch screen control of integrated devices safely, reliably and in different rooms. Users are free to move from one operating theatre to another, using a handheld unit to control the devices in each room. Thanks to its novel, real-time localization capability, TruConnect recognizes exactly which devices a particular room has and how they are configured, ensuring that mobile control is safe. Simple and safe control is underpinned by graphical representation of devices. The system also supports the use of multiple portable TruConnect Control devices at the same time in one operating theatre. This means one person can be adjusting the operating table while another person attends to the surgical lighting, camera and image documentation. Now for the first time, certain devices can be visualized in 3D. Depending on the device, a 3D visualization of integrated devices can be displayed on the touch screen and adjusted with simple swipe gestures. For instance, if the operating table’s left leg plate needs to be angled down, all the controller has to do is to tap the plate on the 3D visualization and drag it downward. The control panel helps by providing a simulated preview and information such as the current tilt angle. With elements clearly organized on the screen, it takes almost no time at all to master the system. There are short, easy-to-understand video tutorials to complement the intuitive control concept. It is quick and easy to switch between available devices and call up tutorials or device manuals. The system fulfills all hygiene requirements of today’s surgical wings. Communication between the portable TruConnect Control unit and the TruConnect server is managed by the TruConnect Wallstation. Taking up a minimum of wall space in the operating theatre, the Wallstation can be installed just as easily in new buildings as when refurbishing existing ones. The portable control is a handheld nerve centre with a touch screen. Impact-protected by a bumper, its special case means it can be used in sterile environments. Using reliable induction technology, it can be charged up quickly and wirelessly via the TruConnect Dock, which simplifies cleaning and eliminates unnecessary cabling. TruConnect is based on a flexible, extendable app concept coupled with a range of innovative technologies. It can be used to control Trumpf operating tables, lights, cameras or the customer’s own music selection. Smartphones, iPads and iPads can be controlled via a wireless connection. The app concept is designed to integrate additional functions.

TRUMPF

www.ihe-online.com & search 46613

Cricothyrotomy surgical set

In response to the NAP4 study addressing the clinical need for both Seldinger1 and surgical cricothyrotomy procedures to be taught side-by-side, Cook Medical is introducing a compact surgical set. This cricothyrotomy range expansion allows clinicians to stay up to date with the latest developments. The new surgical set can be used both inside and outside hospital settings. It is specifically packaged for procedural use and ideal for smaller work spaces. It is also easily transported in medical kit bags and packs. When a patient loses an airway, physicians often only have seconds to make a life-saving decision. Training and preparedness are key for successful surgical and Seldinger cricothyrotomy procedures. It is critical that healthcare institutions provide the equipment and training necessary for their staff to deal with emergency airway access procedures. Although it is a rare procedure, a cricothyrotomy can mean the difference between life and death. Being able to carry it out quickly minimizes the risk of damage from oxygen starvation.”

COOK MEDICAL

www.ihe-online.com & search 46598

Compact ultrasound scanner

Compact and modern, the ExaHyne ultrasound scanner is developed in accordance with the needs of the medical environment for fast and reliable diagnoses. Benefitting from a large range of wideband probes, the scanner is convenient for all clinical applications, including cardiology and 4D imaging in obstetrics. The interchangeable long-life battery enables the user to work in total freedom without electrical power supply during several hours and offers the versatility of using the scanner both in the clinic and for non-sedentary scanning. The intuitive and ergonomic user interface includes many automatic functions and customizable features, providing for easy, fast and user-friendly operation. Because of its fully digital design, the ExaHyne scanner is also easily upgradable.
HIS and document/image management system

Soarian is a Healthcare Information System that offers an innovative workflow-driven design and addresses the dynamic nature of patient care. It positions healthcare organizations to manage processes, as well as clinical data, supporting the whole patient diagnostic and treatment workflow—across departments, disciplines, and care environments—to help improve operational efficiencies and the business of healthcare. Soarian supports hospital workflows due to the advanced Workflow Engine, the adaptable, ergonomic user interface and Web-based technology, a state-of-the-art and future related architecture.

The Soarian Health Archive (SHA) is the central scan and document management solution for all paper documents as well as old paper patient records, patient consent forms, and forms that were stored not only digitally but also as paper documents.

Digitized paper documents as well as digital documents are administered via SHA and archived via syngo.share. The contents become integral part of the electronic patient record in Soarian thanks to the extended interoperability among Siemens products such as SHA, syngo.share and other syngo products. At present, documents that have not yet been archived or made available to customers can be scanned via this scan solution. In addition the syngo.share platform enables archiving as well as managing and distributing images, videos and documents even within medical centres. The platform is suitable for long-time archiving of documents that are administered in the clinical document management system SHA. Optionally, syngo.share provides the technical basis for the IHE exchange of medical documents and images among different regional healthcare facilities.

For this purpose, a Cross-Enterprise Document Sharing (XDS) profile or XDS for Imaging (XDS-I.b p) profile is used. Within its framework, syngo.share is used as a XDS(-lb) archive—a so-called repository—for university medical centres as well as for other hospitals. It integrates data streams from special systems used in radiology (PACS), cardiology, surgery as well as image and video sources for various specialty departments, enabling access for Soarian.

RTI ELECTRONICS AB

www.ihe-online.com & search 46597

Portable 3/6/12 channel electrocardiograph

The AsCARD Grey 3/6/12 channel electrocardiograph is equipped with a built-in HL7 protocol enabling integration with the HIS and the sending of ECG examinations directly from the device onto an e-mail box. AsCARD Grey allows a review of performed examinations with analyses and interpretation on a large LCD TFT colour touch screen of high resolution. The full report of ECG examinations may be printed in A4 format directly on an external printer or may be saved in PDF or XML files as well as stored on a Pen Drive. One of the main advantages of the electrocardiograph is its interfacing capability with database and archiving software. Moreover, the device may be used to conduct preliminary spirometry examination with the use of a special spirometry attachment. In addition, a multilingual intuitive menu enables user-friendly operation in most regions worldwide.

RTI ELECTRONICS AB

www.ihe-online.com & search 46603

PRODUCT NEWS | 31 |
**Clinical movement analysis system**

The Flamenco Clinical Movement Analysis System allows capturing movement with up to 4 video cameras, perfectly synchronized with a ground reaction force vector and up to 16 channels of EMG. The system was developed in close collaboration with several clinical gait analysis labs. It is an effective tool for clinical decision making in a wide range of pathologies, including cerebral palsy and stroke. The Flamenco system enables physiotherapists and other rehabilitation professionals to assess a patient's gait in less than one hour, without the need for an engineer to run the system.

**TWENTE MEDICAL SYSTEMS**

www.ihe-online.com & search 46587

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**Point of care lysine analyser**

Amino Sign is a point of care analyser to measure lysine easily and quickly. Lysine, or L-lysine, is an essential amino acid. That means it is necessary for human health, but the body can't manufacture it, so the only sources are dietary, including supplements. Amino acids like lysine are the building blocks of protein.

Lysine is important for proper growth, and it plays an essential role in the production of carnitine, a nutrient responsible for converting fatty acids into energy and helping to lower cholesterol. Lysine appears to help the body absorb calcium, and it plays an important role in the formation of collagen, a substance important for bones and connective tissues including skin, tendon, and cartilage. Most people get enough lysine in their diet, although athletes, vegans who don't eat beans, as well as burn patients may need more. Not enough lysine can cause fatigue, nausea, dizziness, loss of appetite, agitation, bloodshot eyes, slow growth, anemia, and reproductive disorders. For vegans, legumes (beans, peas, and lentils) are the best sources of lysine. Amino Sign uses the Lysine Card test strip in a 4-step procedure to measure lysine concentration in whole blood specimens. Sample volume is 5μL and the test is performed in two minutes. The pocket size analyser's dimensions are 115x58x20mm.

**TECHNO MEDICA**

www.ihe-online.com & search 46585

**Colour display for diagnostic use**

Suitable for all diagnostic conventional X-ray applications, the new 6 Megapixel CCL650i2 colour display has a screen size of 30 inch and a brightness of 800cd/m². The CCL650i2 is equipped with LED backlight. The successor of the CCFL technology is based on semiconductors and is known from a variety of consumer products. The benefits are both ecological as well as financial and qualitative. Compared to CCFL monitors, LED displays save up to 20% electricity and have a longer life span (about 30%). This has a positive effect on the user's budget. Furthermore CO2 emission decreases thanks to reduced energy production. Specifically, those displays will use 15% less power than their predecessors. At the same time the lifetime almost doubles and disposal is much more environmentally friendly, since LEDs do not contain critical elements such as mercury. Thanks to the newly developed power supply, standby power consumption is reduced by 80%. Together with the backlight dimming function this results in significant cost savings. Moreover the full remote management reduces administration time. In addition, the CCL650i2 offers a newly developed flexible input concept with a dual DVI and Dual DisplayPort Input allowing users to connect two signals from one workstation or to connect two workstations. With Display Port, all recent AMD or NVIDIA cards, can be connected. For older Matrox MED or RAD cards the CCL650i2 supports a 3MP simulation mode, ensuring full compatibility.

**TOTOKU**

www.ihe-online.com & search 46620

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**FRONT COVER PRODUCT**

16-slice CT scanner

Designed for the entry-level segment, Somatom Scope offers remarkably efficient operating costs over the entire operational lifetime (average of 8 years) – up to 35% lower than with the previous model. The new CT scanner is available in two configurations: the particularly cost-effective Somatom Scope and the higher-performance Somatom Scope Power. Both models include the eCockpit technology package, which makes the systems easier to use and extends their operational lifetime. Several factors are responsible for the noticeable reduction in overall operating costs, beginning with the very low space requirement of just eight square meters and the light weight of the new CT scanner. This means that it can be installed in almost any room with little inconvenience. Energy consumption also plays an important role throughout the entire lifespan. Several energy-saving functions not only reduce the energy required by both Somatom Scope configurations, but also save on air conditioning thanks to low heat emissions. Energy savings of up to 65% can be made compared with the previous generation. The eCockpit technology package helps to further reduce energy costs through its eSleep function, which puts the gantry in sleep mode if it is not used for an extended period. In addition to eSleep, the other innovative technologies of the eCockpit are also incorporated for routine scanners. eMode and eStart not only make it easier to use the Somatom Scope CT scanner and extend its lifespan, but also enable further savings over the entire operational lifetime. For example, eMode (already known from Somatom Perspective) automatically selects the optimum scan parameters to reduce wear and tear on the scanner hardware, thus making the device more efficient and reducing maintenance costs and device downtimes while maintaining the right balance between radiation dose and image quality. In addition, eStart extends the lifespan of the X-ray tube – one of the most expensive CT components – by a dedicated warm-up procedure before the first scan after longer periods in stand-by to protect the tube material. This avoids cold starts, which place considerable strain on the tube. With the combination of eStart, eMode and eSleep in the eCockpit, all phases of the scanner utilization, from stand-by to warm-up to scan, are taken into consideration in order to increase efficiency and scanner uptime.

**SIEMENS HEALTHCARE**

www.ihe-online.com & search 46619
Continuous ECG monitoring system

eMotion ECG Mobile is an FDA approved device for continuous ECG monitoring. The system contains a lightweight and comfortable wireless ECG sensor. This sensor continuously transmits the readings via Bluetooth to a mobile phone. The data is then uploaded to a secure server for analysis or online viewing of the data. If the device detects any irregularities in the ECG readings, it sends an alarm with the GPS locations of the patient over the mobile network to ensure immediate treatment to prevent further deterioration and possibly save the patient’s life. eMotion ECG Mobile gives patients the flexibility to continuously monitor their heart outside the confines of a clinic, which is also a huge benefit to hospitals and caregivers, allowing them to watch over a larger population more effectively in terms of costs and resources.

MEGA ELECTRONICS
i www.ihe-online.com & search 46583

POC ultrasound for interventional radiology

The FUJIFILM SonoSite X-Porte point-of-care ultrasound system is particularly well suited to interventional radiology. The image quality is very high and it has a large, full-screen display and a resolution that is comparable to much larger instruments. The very rapid boot-up time and good battery life are also perfect for interventional procedures, particularly as the system is so portable and robust, meaning it is always available where and when needed. The X-Porte is very easy to use thanks to a most intuitive interface and the built-in electronic manuals and online help mean that virtually no training is required. It has few controls, allowing the user to quickly set the gain, brightness, depth and colour Doppler. The lack of mechanical buttons also simplifies infection control; a sterile cover can be placed over the entire system enabling the user to operate the touch screen with gloved hands, then quickly and easily wipe it down between procedures.

SONOSITE
i www.ihe-online.com & search 46618

Strong domestic and international support drive growth of MEDICAL FAIR ASIA 2014

In just four months, Singapore will once again play host to MEDICAL FAIR ASIA, as it makes a much anticipated return on 9 to 11 September 2014 at Suntec Singapore. The 10th edition of the international exhibition on Hospital, Diagnostic, Pharmaceutical, Medical & Rehabilitation Equipment & Supplies continues its tradition of show-on-show growth, with an expected 25% increase in exhibitors from its 2012 edition. Extremely positive exhibitor response has resulted in a marked increase in space bookings received, which sees the show expand across two exhibition levels to meet the growing demand for floor space. Further driving this growth is the strong support received in the international arena, with new and returning nations Italy, Spain, Hungary, Turkey and The Netherlands showing keen interest in joining a broad line-up of country pavilions which already include Germany, Austria, France, UK, USA, China, Taiwan, Singapore, Korea, Japan and Malaysia.

Organized by Messe Dusseldorf Asia, Medical Fair Asia brings together all facets of the medical and healthcare industry for networking, sharing of best industry practices, as well as product, service and solutions development. Part of MEDICA – World Forum for Medicine, a global series of medical events, MEDICAL FAIR ASIA’s contribution and growing relevance to the region and its associated industries is further underlined by the endorsement and continued support it receives from the Ministry of Health Singapore, Singapore Tourism Board and the Singapore Exhibition and Convention Bureau as well as hospitals and medical associations all across Asia. Complementing the trade fair will be a feature-packed conference focused on breakthrough technologies in the many fields of medicine including Urology, Oncology, General Surgery, Nursing and Aesthetics. Medical experts from across the region will congregate at this conference as they look to share their wealth of knowledge and industry experience with participating delegates.
KIMES 2014: the Seoul-based medical exhibition celebrates 30 years of success

The 30th Korea International Medical & Hospital Equipment Show (KIMES) was held March 13 to 16 in Seoul. As a major meeting point for medical equipment manufacturers, end users and distributors, KIMES is ideally positioned to maximize business and learning opportunities in the medical sector, serving as a hub of information exchange for the whole Asia region, including Northern and South East Asia.

Close to 1,100 suppliers were showcasing their latest innovations, led by the global brand owners such as GE, Fuji, Shimadzu, Hitachi, Siemens and Philips, over 38,350 square meters of exhibition space. Besides Korea, all the major manufacturing countries were represented, with the highest exhibitor numbers coming from China, US, Germany and Japan (see table for complete breakdown by country).

The event attracted a total of over 71,000 visitors over the four days of its duration, registering a growth of 4.4% compared with last year. Organized jointly by Korea E & Ex, the Korea Medical Devices Industrial Cooperation Association and the Korea Medical Device Industry Association, KIMES is specially sponsored by the Ministry of Trade, Industry and Energy, reflecting the importance of the medical technology sector for the Korean economy.

Educational opportunities
On the learning side, 98 in-depth seminar sessions were concurrently held in the COEX Conference Center during the show. The topics covered a broad range of issues from government policies on medical devices to the latest technologies. Specific sessions were also organized for healthcare professionals and physicians.

Number of exhibitors by country at KIMES 2014

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