

**Chapter 1 : The Latest in Ultrasound Technology | DAIC**

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Abstract Pleural malignancies constitute either primary pleural malignancies, such as malignant pleural mesothelioma (MPM), or secondary pleural tumours, either from pleural metastasis or direct extension of adjacent tumours. Mesothelioma is a rare aggressive tumour of the pleural surfaces associated with prior asbestos exposure. Mesothelioma is also a challenging disease from a diagnostic staging, and treatment perspective and is rarely cured despite multimodal treatment. With incidence continuing to rise, this disease represents a serious global problem that needs urgent attention. This review provides an in-depth review of MPM. Recent advances in diagnostic approaches, such as imaging techniques and the role of immunohistochemistry and biomarkers, are discussed. Treatment modalities, including chemotherapy, radiotherapy, and surgery as part of a multimodal approach, are reviewed, as well as the management of malignant pleural effusions. It is a challenging disease from a diagnostic, staging, and treatment perspective and is rarely cured despite multimodal treatment. During the past 20 years, important advances in the diagnosis and management of MPM have occurred; however, much is still left to be understood about this devastating disease. In this paper we provide an in-depth review of MPM with a focus on recent advances in imaging and biomarkers. Environmental exposure to asbestos erionite fibres naturally existing in the soil of areas such as Turkey, Corsica, and Cyprus, and neighbourhood exposures in people living close to asbestos factories, have also been described as risk factors for MPM. Paraoccupational exposure of household members to asbestos from the clothes of asbestos workers, as well as exposure to ceramic refractory fibres, ionising radiotherapy, and simian vacuolating virus 40, have also been linked to MPM. MPM portends extremely poor outcomes, with a median survival of 9–12 months. It has a 4: MPM is subdivided into four histological subtypes: The sarcomatoid type of MPM is associated with the poorest prognosis, with a median survival of 4 months. To date, there is no single diagnostic test with adequate sensitivity and specificity for early diagnosis in asymptomatic subjects. Depending on the presence of pleural effusions or thickening, the extent and laterality, and the presence of calcified pleural lesions, the contribution of imaging can differ significantly, from providing diagnostic or staging information to differentiating benign from malignant pleural thickening. Radiological interpretation is more challenging in early disease with minimal or absent pleural thickening, and staging can be difficult due to the heterogeneous growth patterns of MPM. Ultrasound Contrast-enhanced thoracic ultrasound can quantify pleural effusions or thickening, identify nodules on the pleura or hemidiaphragm, and evaluate their degree of vascularisation. CT also has a limited role in the staging of MPM, as it is suboptimal for detecting mediastinal lymph node metastases and underestimates early chest wall invasion and diaphragmatic and peritoneal involvement. This is because mesothelioma has similar tissue attenuation to nearby structures, including the chest wall musculature, diaphragm, and pericardium. Moreover, PET is associated with high false-negative rates in early disease<sup>6</sup> and high false-positive results in tuberculous pleuritis, parapneumonic effusions,<sup>7</sup> and prior pleurodesis. It can detect chest wall or extrapleural invasion, such as mediastinal or diaphragmatic extension, more reliably than CT. Therefore, obtaining adequate samples from pleural biopsies, both in quantity and quality, is essential. The low complication rates make it a safe procedure in patients with suspected MPM. The more extensive approach, however, allows for combined diagnosis and treatment in one procedure. VATS with mediastinoscopy is recommended when mediastinal nodal involvement is suspected. It is most helpful in differentiating epithelioid MPM from pleural metastasis of epithelial malignancies, such as primary adenocarcinoma of the lung. Current guidelines recommend the use of monoclonal antibody panels<sup>16</sup> with at least two positive mesothelial markers and two negative carcinoma markers for the diagnosis of MPM. Immunohistochemical markers used in the differential diagnosis between epithelioid malignant pleural mesothelioma, lung carcinoma, and other carcinomas. Sarcomatoid tumours express pan-cytokeratins, vimentin, and markers of smooth muscle differentiation, such

as smooth muscle actin, but test negative for most mesothelial markers, with the exception of D and calretinin. Because of this, the diagnosis of sarcomatoid MPM requires at least two pan-cytokeratins, two non-mesothelial markers, and supporting clinical or imaging data. Their clinical application, however, is characterised by low sensitivity, specificity, and reproducibility, with variable results reported by published studies.

**Serum mesothelin** The most widely used biomarker is serum mesothelin. Elevated levels of serum mesothelin are common in patients with MPM compared to patients with pleural metastases or asbestos-related benign pleural disease. Its greatest role is in monitoring treatment response, as SMRP levels correlate with tumour size and progression. Its role as a useful biomarker for diagnosis and prognosis of MPM has been studied thoroughly. Moreover, both serum<sup>23</sup> and plasma<sup>22</sup> OP levels correlated with survival. Studies on the diagnostic power of OP, however, have produced conflicting results. This is because OP in serum is unstable, due to thrombin cleavage during the coagulation process, leading to unreliable results. Plasma OP, on the other hand, may have better diagnostic performance. They are stable tissue-specific molecules that can differentiate mesothelioma from pleural metastases. Several studies have explored different miRNA expression profiles in MPM tissues, serum, and pleural fluid, using microarray profiling and quantitative real-time polymerase chain reaction. These studies have helped determine a subset of miRNA that are differentially expressed between MPM and healthy tissue. Specific miRNA for each histopathological subtype have also been identified. For example, miR has been consistently shown to be downregulated in MPM tissue compared to normal pleura. Although larger studies are needed to validate its diagnostic performance, this novel technique could also identify potential targets for treatment. A multidisciplinary approach to define best treatment strategy is preferred. Treatment is dictated by the extent of tumour invasion and pre-operative TNM staging. Unfortunately, staging is often corrected intra-operatively after direct visualisation of tumour extension. Because mesothelin is highly expressed by mesothelioma cells, it makes a suitable target for immunomodulators. Several anti-mesothelin therapies, such as amatuximab, a chimeric monoclonal antibody,<sup>40</sup> and recombinant immunotoxins,<sup>41</sup> have shown improved response rates and overall survival in smaller studies. These drugs are currently being studied in larger, randomised clinical trials.

**Radiation Therapy** While RT has not demonstrated a survival benefit in MPM, it plays an important role in palliation and symptom management. RT to large areas of the body, such as the whole hemithorax, carries significant risks of organ toxicity, especially to the lung, liver, heart, bone marrow, and oesophagus. For palliation, a short course of RT is often used to relieve the chest pain from chest wall invasion. The large surface of the pleural space and tumour growth in the diaphragmatic creases and the lobar fissures, however, require high doses to achieve local control, which exponentially increases toxicity risk. EPP involves complete removal of the visceral and parietal pleura and the ipsilateral lung, resection of the ipsilateral pericardium and diaphragm, and dissection of mediastinal lymph nodes. Unfortunately, obtaining negative resection margins is extremely difficult to achieve intra-operatively, due to the proximity to adjacent structures. EPP is a more extensive surgery, reserved for patients who are candidates for multimodal therapy with neoadjuvant chemotherapy and post-surgical RT. It is used for patients with diffuse parietal involvement but small local visceral invasion. A retrospective review of patients showed slightly increased survival with EPP. These findings, however, were thought to be largely due to selection bias and patient factors. The feasibility study could only enrol 45 patients and, even in this small cohort, survival benefit, albeit small, was in favour of no EPP. While some studies report improved day mortality rates, the biggest limitation has been high complication rates and feasibility, with less than half of patients successfully enrolled. The diagnosis of MPE is an ominous sign of widespread metastasis and portends a grave prognosis, with median survival of 4 months. MPE can decrease quality of life due to dyspnoea, cough, and chest pain. Treatment is tailored towards symptomatic relief with pleurodesis to prevent recurrent effusions. Chest tube pleurodesis requires drainage of the pleural effusion via chest tube insertion, followed by installation of sclerosing agents into the chest tube. Sterile talc is the most effective sclerosing agent and is therefore preferred over tetracycline, bleomycin, or doxycycline. Thoracoscopic pleurodesis can be performed by VATS or pleuroscopy, where mechanical pleural abrasion precedes instillation of sclerosants into the pleural space. VATS pleurodesis is the preferred method because it allows for better distribution of talc and release of adhesions, causing complete

lung expansion and improved apposition of pleural surfaces. Pleurodesis may be difficult to achieve in patients with trapped lungs or multiple loculations, as it requires the lung to expand against the chest wall with apposition of visceral and parietal pleural membranes. Pleurodesis is most effective when performed early. It is as effective at relieving symptoms as talc slurry via chest tubes, and can sometimes lead to spontaneous pleurodesis. Complications include infection, displacement, catheter tract metastases, and tube blockage. Identifying biomarkers for earlier disease detection, perfecting protocols for multimodal treatment, and developing novel therapeutic approaches are of utmost importance. Promising advancements in diagnostic tools, such as novel biomarkers in pleural effusions and serum, as well as IHC and signature miRNA, will help with earlier detection and accurate tumour profiling. Advancements in therapies, including immunotherapy, intrapleural gene therapy via adenovirus,<sup>59</sup> exosome-delivered miRNA, and other drug delivery systems,<sup>60</sup> as well as TPC with a drug-eluting coating to deliver intra-pleural sclerosing agents over time,<sup>56</sup> offer hope for a better diagnosis and treatment of this disease. References Scherpereel A et al. Guidelines of the European Respiratory Society and the European Society of Thoracic Surgeons for the management of malignant pleural mesothelioma. Meyerhoff RR et al. Impact of mesothelioma histologic subtype on outcomes in the Surveillance, Epidemiology, and End Results database. Qureshi NR et al. Thoracic ultrasound in the diagnosis of malignant pleural effusion. Hallifax RJ et al. Role of CT in assessing pleural malignancy prior to thoracoscopy. Yamamuro M et al. Morphologic and functional imaging of malignant pleural mesothelioma. Treglia G et al. A systematic review and meta-analysis. Bury T et al. Vandemoortele T et al. Three cases of benign talcoma. Zahid I et al. What is the best way to diagnose and stage malignant pleural mesothelioma? *Interact Cardiovasc Thorac Surg*. Zielinski M et al.

**Chapter 2 : A Look at the Latest Advancements in Ultrasound**

*Ultrasound (US) is one of the most frequently used imaging methods in the clinic. The broad spectrum of its applications can be increased by the use of gas-filled microbubbles (MB) as ultrasound contrast agents (UCA).*

Fujifilm Sonosite took a different route for handheld systems with its iViz ultrasound system. The system automatically identifies the anatomy and then creates both measurements and ideal image plane 2-D diagnostic views to speed workflow and reduce variability in imaging between sonographers. Philips opened a new segment of the market when it introduced Lumify, the first mobile app-based ultrasound system. It turns any Android based phone or tablet into a point of care ultrasound system. Read a update on cardiac ultrasound technologies "Recent Advances in Echocardiography Technology" There were some big innovation trends in cardiac ultrasound in These included the launch of the first premium all touchscreen ultrasound system; the introduction of artificial intelligence to speed, simplify and make cardiac echo more reproducible; and a big advancement in image quality, approaching that of computed tomography CT scans. Additionally, vendors continue to improve overall image quality, ergonomics and workflow and automation on premium-tier systems to handheld, point-of-care POC solutions. Vendors also are concentrating efforts to deliver more affordable systems due to the current economic and healthcare reform climate. Prior to recent automation software, this was very time consuming. Similar to a CT scan, 3-D ultrasound captures a cone shaped volume of image data, which can be sliced and viewed on any plane. This utilizes advanced algorithms to capture much larger amounts of data than possible on previous echo systems – roughly a DVD worth of data per second. The technology also selects pixel-by-pixel the most precise information to display. The larger amount of image data that is processed and the new image processing offers much more refined delineation of tissue layers in the myocardium, enhancement to structures such as chordae tendineae, and the ability to more accurately visualize thrombus. GE also launched version 2. Compared to the first generation Logiq E9, version 2. It is the first all touchscreen controlled premium ultrasound system. The sealed touchscreen panel is supposed to enable easier infection control measures and streamline operation. The system offers compatibility with several transducers and users can select the desired transducer type with one touch. Artificial Intelligence One of the biggest issues in echocardiography has been reproducibility of imaging, where exams will vary based on sonography experience and the techniques they use. Philips introduced its solution to this problem last summer with artificial intelligence software that automatically takes the image volume data from 3-D echo and recreates the optimal version of required diagnostic views. AIUS also uses the 3-D dataset to automatically compute quantification measurements to help clinicians quickly and easily assess disease states and determine treatment with highly reproducible results. Compared to 2-D exams, Philips said the Epiq 7 with AIUS is able to gather left ventricular and atrial volumes and dimensions three to six times faster than manual or semi-automated methods. Visualizing Small, Low-flow Vessels Toshiba has focused in recent years on perfusion of small, slow-flow vessels, especially to assess organ perfusion, which has traditionally been difficult on ultrasound. The company introduced its SMI Superb Micro-Vascular Imaging software in to capture 2-D images of these vessels, and this year introduced a 3-D version on its Aplio and systems. The technology displays small vessel beds with Doppler flow in grayscale or false-color 3-D reconstructions, which can be fully rotated for even better visualization. Philips Healthcare opened a new segment of the market last June when it introduced Lumify, the first mobile app-based ultrasound system. The transducer performs all of the acquisition functions and a portion of the image reconstruction processing, with the smartphone serving as the display screen and the connection link to the cloud storage archive. Fujifilm Sonosite took a different route for handheld systems, introducing the dedicated iViz ultrasound system at RSNA While users can perform a number of different exams with vibrant color flow images on the high-resolution, 7-inch display touchscreen, acquisition is only part of the emphasis: This means the device can populate patient data from the EMR as well as send reports with just a few taps. In July , Mindray introduced its touchscreen TE7, which operates like and is a similar size to a tablet. Users can tap to start functions, pinch and drag to zoom in and out, and swipe to expand the image. The TE7 features numerous

exam presets, with several enhanced cardiac functions including continuous wave Doppler and a transesophageal echo TEE transducer. While the future of handheld ultrasound looks bright, according to Brubaker, the technology is still in its infancy, so time will tell what its role will be. The company said about half of these sales were just for the most recent version released at RSNA , which offers a combined double-ended probe for both linear and phased array imaging. Comparison Chart of Ultrasound Systems This article served as an introduction for a comparison chart of ultrasound systems in our print issue. To view the chart you will need a login, but it is free and only takes a minute. The vendors in the chart include:

**Chapter 3 : Recent Advances in Ultrasound in Obs. & Gyn.**

*If the address matches an existing account you will receive an email with instructions to reset your password.*

Philips offers transducers for surgical applications on its compact CX50 ultrasound systems. With ever-increasing concerns about radiation dose and the appropriate use of diagnostic imaging tests, doctors are continuously looking for ways to better image their patients. Advances in ultrasound are making the technology appear more attractive for certain clinical applications, from breast health to cardiology, thanks to their noninvasiveness, cost-effectiveness and lack of radiation. Some of the emerging innovations in ultrasound, such as real-time 3-D imaging and the development of wireless transducers, are set to keep the market going throughout and beyond. Companies are also working to improve compact ultrasound systems for use in tight premium spaces within hospitals, such as in the operating room. The system is targeted toward use in interventional applications such as radiology and cardiology, and Cannon said it could also be used to aid in vascular access procedures as well as needle visualization. The system uses a proprietary 8 GHz ultra-wideband radio frequency to transmit data to the main console, and also includes Bluetooth wireless control. Enhancements to Traditional Ultrasound Other recent technological trends in ultrasound include advances for contrast-enhanced imaging, volume imaging and elastography. In addition to providing real-time imaging of internal anatomy, these advances in ultrasound allow doctors to image blood perfusion and blood flow, view real-time 3-D imaging of structures, and more easily differentiate malignant tumors from the benign, among other functions. The availability of contrast-enhancing microbubbles gives doctors the ability to more clearly delineate between tissue and fluids, said Edward Leen, M. By enhancing the reflection of ultrasound waves, microbubbles create a clearer contrast between individual organs and blood flow in the image. Other features of contrast-enhanced ultrasound CEUS include the ability to display vascularity in rendering modes and to more easily characterize malignant liver lesions for oncology applications. Additionally, limitations with 2-D ultrasound for interventional applications have many clinicians looking toward 3-D and 4-D ultrasound for real-time volume imaging, made possible by the continuous increase of computing power in ultrasound systems. Its Smart Fusion technology provides the ability to synchronize ultrasound imaging with computed tomography CT or magnetic resonance MR image, improving the detection of hard-to-find lesions. In combination with advanced visualization functions, 3-D ultrasound can aid complex surgical applications and interventional procedures, according to Leen. Images are reconstructed from echoes sent by the transducer from multiple angles, and with 4-D ultrasound real-time moving images can be produced. These latest transducers are also becoming smaller in size than previous generations, Leen said. This in turn can improve various parts of the workflow – namely, shortening exam times and reducing the risk of repetitive strain injury RSI for operators. Furthermore, he said 3-D advances are making way for functional imaging with ultrasound, as manufacturers start integrating contrast-enhanced capabilities into their new systems. The overall lower costs of high-end ultrasound systems in comparison to other modalities also add to their cost-effectiveness and appeal to many hospitals. Providing the capability to differentiate between soft normal tissue and stiffer malignant tumors, color-coded elastography maps can be produced by several of the latest ultrasound systems. One technological advance that continues to produce clinical results since its approval by the U. SWE differs from traditional strain elastography, which relies on manual compressions by the examiner to assess tissue displacement, according to Peter N. The SWE technique instead captures shear wave generation with patented UltraFast Imaging technology – currently only available on the Aixplorer ultrasound system from Supersonic – to quantitatively measure the stiffness of local tissues. By being less dependent on an experienced operator, SWE can record elasticity more accurately than conventional elastography and produce a more objective, real-time color-coded map to show tissue stiffness. In October , Supersonic announced FDA clearance of a real-time adjustable numerical scale ANS in meters per second for the technology, allowing clinicians to adjust the scale to optimize visualization of elasticity according to the organ of interest. This adds to the appeal of SWE, since stiffer tissues can vary among different pathologies. Currently it is widely used and studied in breast health applications. In March , results from a multicenter

study, published in the *Radiology* and *European Radiology* journals, showed the technology improves breast ultrasound specificity when detecting breast lesions in patients. Innovation Continues While traditional 2-D ultrasound continues to be widely adopted by a broad range of clinical applications, recent technological advances are opening more areas of interest in the 3-D and 4-D ultrasound markets. Software improvements and more sophisticated computing algorithms are allowing manufacturers to offer smaller, more powerful and more complex systems. These innovations will continue to expand as physicians compare ultrasound with other imaging modalities when choosing how to best diagnose their patients and plan interventional procedures.

**Chapter 4 : Advances and utility of diagnostic ultrasound in musculoskeletal medicine**

*Other recent technological trends in ultrasound include advances for contrast-enhanced imaging, volume imaging and elastography. In addition to providing real-time imaging of internal anatomy, these advances in ultrasound allow doctors to image blood perfusion and blood flow, view real-time 3-D imaging of structures, and more easily differentiate malignant tumors from the benign, among other functions.*

Feature Ultrasound Imaging March 02, Jeff Zagoudis Advances in Ultrasound Image quality enhancements and ease of use for multiple applications and settings, including the point of care, are driving new innovations Fujifilm Sonosite took a different route for handheld systems with its iViz ultrasound system. Philips opened a new segment of the market when it introduced Lumify, the first mobile app-based ultrasound system. Ultrasound imaging took some major steps forward in , with innovative new systems and technologies debuting across multiple market segments. And vendors are realizing that what works for one organization may not work for every organization. This utilizes advanced algorithms to capture much larger amounts of data – roughly a DVD worth of data per second – and selects pixel-by-pixel the most precise information to display. The company also launched version 2. Compared to the first generation Logiq E9, version 2. AIUS uses the enhanced 3-D view and advanced quantification functionality to help clinicians quickly and easily assess disease states, determine treatment and guide related therapies, with highly reproducible results. Compared to 2-D exams, Epiq 7 with AIUS is able to gather left ventricular and atrial volumes and dimensions three to six times faster. Toshiba has focused in recent years on perfusion of small, slow flow vessels in organs, which has traditionally been difficult on ultrasound. The company introduced its SMI Superb Micro-Vascular Imaging software in to capture 2-D images of these vessels, and this year introduced a 3-D version on the Aplio and systems. The technology displays small vessel beds with Doppler flow in grayscale or false-color 3-D reconstructions, which can be fully rotated for even better visualization. Software developers are also helping to improve 3-D ultrasound visualization. ContextVision last year introduced the second generation of its GOPiCE image processing software, which provides real-time volumetric image processing for 3-D ultrasound. While the visualization improvements with 3-D ultrasound are undeniable, the technology has yet to see widespread adoption, according to Brubaker. The system also incorporates HDlive technology to provide four times the ultrasound pathways for improved clarity with increased penetration. Ergonomics at the Point of Care Improving ease of use has been an essential factor in the growth of ultrasound imaging, particularly as the demand for POC solutions has expanded. This has led to the introduction of touch-enabled ultrasound systems, which enhance mobility by sacrificing cumbersome keyboards. Several vendors have addressed these challenges by introducing handheld ultrasound systems that can easily be transported anywhere. Philips Healthcare opened a new segment of the market last June when it introduced Lumify, the first mobile app-based ultrasound system. The transducer performs all of the acquisition functions and a portion of the image reconstruction processing, with the smartphone serving as the display screen and the connection link to the cloud storage archive. Fujifilm Sonosite took a different route for handheld systems, introducing the dedicated iViz ultrasound system at RSNA While users can perform a number of different exams with vibrant color flow images on the high-resolution, 7-inch display touch screen, acquisition is only part of the emphasis: This means the device can populate patient data from the EMR as well as send reports with just a few taps. While the future of handheld ultrasound looks bright, according to Brubaker, the technology is still in its infancy, so time will tell what its role will be. Handheld systems are just one iteration of the new touch-enabled ultrasound units; many are still cart-based while still offering increased flexibility. Both versions feature a sealed, all-touch control panel that combines the speed and flexibility of a soft user interface with the tactile feedback of traditional keys. Etched markings for primary controls help the user easily locate key functions without looking away from the display monitor. The tablet-style device attaches to a slim-profile cart, allowing easy mobility. Users can choose from several different exam presets with a single touch, including cardiovascular capabilities like continuous wave CW Doppler, and a series of emergency department-specific exams. Image optimization is also a one-touch function.

**Chapter 5 : Advances in Diagnostic and Therapeutic Ultrasound Imaging**

*Advances in ultrasound over at least the last decade have opened up new areas of inquiry and potential clinical efficacy in the context of pain diagnosis and treatment. Here we offer an overview of the recent literature associated with ultrasound and pain in order to highlight some promising frontiers at the intersection of these two subjects.*

Though ultrasound originated within traditional imaging, novel point-of-care applications are now being performed by multiple specialties and are contributing to better patient care pathways that are safer and more economical than traditional imaging. Furthermore, there is a growing body of evidence about the benefits of point-of-care ultrasound and why it should be standard care for many disease states. The impact of ultrasound has grown as new users and new uses demonstrate their usefulness in an expanding variety of settings. Many medical schools are already training students to use ultrasound. My prediction is that all physicians will utilize highly mobile ultrasound in the future. For example, the latest model of the Edge II has been enhanced to accelerate image acquisition, enabling clinicians to make more confident decisions and focus on the patient. This is helping to reduce hospital and patient expenses by decreasing costs to the health system and the time required for diagnosis and treatment," Mandavia says. Rocha has also noticed a trend of ultrasound expanding to new users and new uses, as more compact devices continue to expand the reach of ultrasound. For example, the Lumify app-based ultrasound system can be plugged into a mobile device. They look to us for innovative solutions to operate their businesses more effectively," Rocha says. OmniSphere gives ultrasound managers a clear look into workflow, staffing and equipment utilization, and downtime. In fact, in late , GE Healthcare made history with the production and delivery of its 17,th LOGIQ E9, which is now the most installed premium radiology ultrasound system in history. In terms of cost, product and operating costs have declined, and ultrasound often sits at the clinical point of decision; this helps reduce downstream costs and workflow costs for providers, Sandy adds. And when total cost of ownership goes down, a broader group of potential caregivers and their patients is given access to ultrasound. Another trend Sandy has noticed is the recent approval of contrast imaging for ultrasound in the United States, bringing that market in line with other regions that have been using contrast-enhanced ultrasound for several years to diagnose patients more cost-effectively than with higher cost modalities. Toth says the J5 is well suited for musculoskeletal evaluations that require needle visualization for ultrasound-guided injections and biopsies. Siemens Medical Solutions USA, Inc Peter Pellerito, senior vice president of ultrasound for Siemens Healthineers Ultrasound, notes that the company has been focusing its ultrasound efforts on early breast cancer detection, chronic liver diseases, and prostate imaging. Toshiba Coming out of a year where the major buzz concerned contrast in radiology for ultrasound, the new talk around the modality is how to expand ultrasound in the health care environment. The system features capabilities such as precision imaging, differential tissue harmonics, and advanced dynamic flow. Souquet predicts ultrasound will become even more automated, mobile, definitive, and intuitive for users, making it an indispensable everyday tool for patient diagnosis and care. Rocha would like to see an increased focus on medical education. He says despite significant advancements in technology, ultrasound education has remained relatively stagnant. That bond is paramount. One of the unique characteristics of ultrasound, separating it from other imaging modalities, is the way in which it allows a clinician to remain present with his or her patient at the bedside, preserving the important human connection so key to effective diagnosis and care.

**Chapter 6 : A Glance at Recent Trends in Ultrasound | Imaging Technology News**

*(Read a update on cardiac ultrasound technologies "Recent Advances in Echocardiography Technology") 3-D Ultrasound Enhances Visualization A desire to improve image quality is pushing ultrasound manufacturers beyond the capabilities of traditional 2-D imaging and increasing the roll-out of 3-D and even 4-D ultrasound systems.*

**Chapter 7 : Recent advances of ultrasound imaging in dentistry - a review of the literature. - Arizona TMJ**

*Ultrasound is used widely for the detection and characterisation of ovarian lesions both for screening and in the symptomatic female pelvis. B-mode is the first-line tool for detection of masses and provides some initial information relating to whether appearances may be due to benign or malignant pathology.*

## Chapter 8 : Advances in Ultrasound | Imaging Technology News

*Recent diagnostic advances in EUS include staging of lung cancer, IDUS for assessment of pancreaticobiliary pathology, evaluation of mediastinal structures and pancreatic cysts, contrast imaging and the use of larger cutting needles for histological diagnosis.*