Introduction

The history of computed tomography (CT) development has been marked by a number of stepwise increases in scanning speed. The biggest such leap in recent years was taken when spiral/helical technology replaced incremental slice technology. Recent developments in multislice and multidetector (MD) systems have given further impetus to this process. These techniques permit single breath hold volumetric data acquisition in addition to multiphasic imaging. The most useful applications of these systems will not always be in the fast coverage of large anatomical volumes in shorter times but, rather, will frequently be in the coverage of modest volumes in reasonable times with a high Z-axis (isotropic) spatial resolution during a single breath hold [1]. MDCT permits thin-section coverage of large anatomical areas at speeds three to seven times faster than those possible with single-detector helical CT scanners [2–6].

These technological advances have opened new frontiers in hepatobiliary imaging with studies such as CT angiography, CT cholangiography and dynamic multiphasic organ imaging. These advances have impacted on both tumour detection and characterization as well as facilitating more accurate pre-operative planning.

Despite refinements in hepatic surgical techniques, vascular complications still account for considerable morbidity and mortality. Comprehensive and accurate delineation of the hepatic vascular architecture is a prerequisite for a good surgical outcome [5,7–11]. Prior knowledge of arterial anomalies is important, as it may influence patient selection and the surgical procedure. Catheter angiography has long been considered the standard of reference for evaluation. Many centres have now replaced catheter angiography with MDCT angiography because of its non-invasive nature, improved patient compliance and reduced morbidity.

Visualization of the biliary tree using conventional endoscopic retrograde cholangiopancreatography (ERCP) is now being challenged by non-invasive MDCT cholangiography, which has the potential to become a very useful examination for the diagnosis and structural assessment of biliary disease.

The recent original scientific works on the applications of MDCT are presented in this chapter.

Multidetector-row computed tomography angiography for planning intra-arterial chemotherapy pump placement in patients with colorectal metastases to the liver


BACKGROUND. The purpose of this study was to evaluate the use of MDCT in the pre-operative arterial evaluation of patients scheduled to undergo intra-arterial chemotherapy pump placement. The study retrospectively analysed CT scans of 30 patients with hepatic malignancies who were imaged with multiphase MDCT angiography for intra-arterial chemotherapy pump placements. The arterial phase images were processed in order to depict the arterial anatomy and to identify pertinent anomalies. The findings were correlated with surgical or catheter angiography findings. Arterial anomalies were identified on CT angiography in 20 of the 30 patients. There were no additional arteries or anomalies identified by catheter angiography or during surgery. Only one variant, an accessory hepatic artery, was not located during surgery. The surgical team decided that pump placement was not feasible in two patients because of overly complex anatomies as determined by CT angiography. CT angiography showed an overall sensitivity of 100% and a specificity of 97%.

INTERPRETATION. MDCT angiography is accurate for the pre-operative evaluation of normal and aberrant hepatic vasculatures in patients under consideration for intra-arterial chemotherapy pump placement. Axial images alone permit the recognition of vascular anomalies, including complex anatomies. Nevertheless, three-dimensional rendering is useful for evaluating complex vascular anatomies and does not require catheter angiographic confirmation. In addition to aiding in selecting patients ideal for pump placement, MDCT permits non-invasive planning of their surgical approach.

Comment

This study demonstrated that MDCT angiography is highly accurate for pre-operative arterial mapping in patients in whom intra-arterial chemotherapy pump placement is to be performed. In addition, the authors observed excellent concordance between the MDCT findings with the surgical or catheter angiography findings. It is interesting to note that two patients in this study did not have pump placement due to their complex vascular anatomies as determined by the CT angiography. In the authors’ experience this technique was considered very important in surgical decision-making and appropriate patient selection can be reliably performed on MDCT alone.
Dual-phase 3D MDCT angiography for evaluation of the liver before hepatic resection


BACKGROUND. In this study the investigators sought to evaluate the accuracy of dual-phase MDCT angiography for assessing the liver before hepatic resection and to compare two-dimensional and three-dimensional images for quality and arterial branch visualization. Sixty-three cases with colorectal metastases (n = 30), hepatocellular carcinomas (n = 13), giant haemangiomas (n = 5) and other lesions (n = 15) underwent dual-phase MDCT angiography using either a four-row MDCT (n = 31) or an eight-row MDCT (n = 32) scanner. Two reviewers who were blinded to the surgical findings assessed three-dimensional reformatted images of the arterial phase. The reviewers assessed the two-dimensional and three-dimensional images for quality, arterial branch visualization and differences between the four- and eight-row MDCT images. Intra-operative correlation was available in 43 of the 63 patients. The anatomy of hepatic arteries in the 63 patients was classified based on Michels classification. The surgical findings concurred with the MDCT findings in 40 out of 43 (93%) patients. Three discrepancies were due to failure to identify small accessory left hepatic arteries. The branch visualization and image quality of the two-dimensional images were superior to those of the three-dimensional images (Fig. 18.1). There was no significant difference between the four- and eight-row MDCT images in branch visualization and image quality.

INTERPRETATION. Three-dimensional MDCT angiography is accurate for the classification of the hepatic arterial anatomy before hepatic resection. Although the two-dimensional data sets showed small arteries to better advantage than the three-dimensional MDCT angiograms, the three-dimensional MDCT angiograms provided a useful overview of the hepatic anatomy. There was no significant difference in the image quality between the four-row MDCT and eight-row MDCT images.

Comment

MDCT evaluation of the hepatic vasculature is being used for pre-operative evaluation for liver resection. The authors supported the review of both two-dimensional and three-dimensional data sets for accurate assessment of the liver vasculature. The authors found that the visualization of the three-dimensional images provided a useful overview of the hepatic anatomy. However, the peripheral branch artery visualization was better on the two-dimensional than on the three-dimensional images. This was reflected in their results, as small arteries were not identified on the three-dimensional images in three patients, which on retrospect were seen in the two-dimensional data set. In addition, the authors did not find a significant difference between image quality and branch visualization between the four-row MDCT and eight-row MDCT images.

Imaging of hepatic arterial anatomy for depicting vascular variations in living related liver transplant donor candidates with multidetector computed tomography: comparison with conventional angiography


BACKGROUND. The aim of this study was to evaluate liver arteries for depicting variations by using MDCT in donor candidates for living related liver transplants. Sixteen-row MDCT hepatic angiography was performed in 48 donors and the arterial phase images were reconstructed using maximum intensity projections (MIPs) and volume-rendered images. Correlation with catheter angiography was available in 28 donors. Hepatic vascular variants were...
present on MDCT in 22 of the 48 donors with excellent concordance with the findings on catheter angiography (Fig. 18.2) and observations made at surgery. Only a branch of the hepatic artery originating from the superior mesenteric artery that supplied the posterior segment of the right lobe was not identified on MDCT angiography.

**INTERPRETATION.** Pre-operative imaging evaluation of the hepatic vascular anatomy is crucial for surgical planning in living related transplant donors. MDCT angiography is a fast and non-invasive technique that depicts the hepatic vascular anatomy with high sensitivity and specificity. MDCT angiography has the potential for replacing catheter angiography in the future.

**Comment**

Living related liver transplantation is more technically challenging than cadaveric whole-liver transplantation. Vascular complications following transplant constitute a significant morbidity. The accurate pre-operative mapping of the hepatic arterial anatomy is a major prerequisite for donor selection and surgical planning for facilitating safe surgery. It is critical to preserve the arterial supply to the graft as well as to the residual functional donor liver tissue. The presence of certain vascular variants may complicate the surgical procedure and be a potential cause for complications. This study supported the routine use of three-dimensional images alone for accurate evaluation of the arterial anatomy. These improvements in the quality and resolution of three-dimensional images could be due to the near isotropic voxel resolution achieved from 16-row MDCT. The three-dimensional images are now of excellent quality and devoid of artefacts. This study further reinforced the idea that MDCT angiography can reliably replace catheter angiography in the future.

**Fig. 18.2** (a) and (b) Coronal MIP images showing the replaced right hepatic artery (type III) arising from the superior mesenteric artery in a 37-year-old man. (c) and (d) Conventional angiograms confirming the hepatic arterial anatomic variation demonstrated at CT angiography. Source: Coskun et al. (2005).

Living donor candidates for right hepatic lobe transplantation: evaluation at CT cholangiography—initial experience


**BACKGROUND.** This study performed a retrospective evaluation of 62 patients who underwent CT cholangiography for the depiction of second-order biliary tract anatomy in living donor candidates for right hepatic lobe transplantation. The quality of second-order bile duct visualization at CT cholangiography was rated on a four-point scale and the presence of variant second-order biliary tract branching anatomy was noted. The CT cholangiography findings were compared with those at surgery in 24 of the 62 donors. The Fisher exact test was used for comparing the numbers of donors who underwent intra-operative cholangiography before and after the introduction of CT cholangiography. The mean second-order bile duct score at CT cholangiography was 2.9 (range = 2.0–3.0). The biliary tract anatomy determined at CT cholangiography was concordant with the findings at surgery in 23 cases (96%) (Fig. 18.3). Only one variant branch was missed at CT cholangiography (Fig. 18.4). The use of intra-operative cholangiography declined significantly after the introduction of CT cholangiography.

**INTERPRETATION.** CT cholangiography is valuable in delineating the biliary anatomy. It is a non-invasive technique that can be safely used in living donor candidates for right hepatic lobe transplantation. Donors who undergo pre-operative CT cholangiography are unlikely to need conventional intra-operative cholangiography.

**Comment**

Pre-operative assessment of the biliary tract anatomy is an important clinical objective for living related liver transplant donor selection. Biliary complications contribute to a significant post-operative morbidity. A variant biliary anatomy can be seen in up to 45% of the population. In the past, confident evaluation of a nondilated biliary system on CT was difficult. With the availability of biliary contrast agent, CT...
Cholangiography is now feasible. The resolution offered by thin-section MDCT can be exploited to provide superb quality biliary maps. The authors in this study found good to excellent visualization of second-order biliary branches using CT cholangiography. The study shows a good correlation between CT cholangiography and intra-operative cholangiography. CT cholangiography missed an aberrant hepatic duct insertion in only one patient. The authors found statistically significant data showing that, after the use of CT cholangiography in pre-operative evaluation, the need for intra-operative cholangiography decreased. An adverse reaction to the cholangiographic contrast, albeit mild, was seen in two patients in this study. The authors found statistically significant data showing that, after the use of CT cholangiography in pre-operative evaluation, the need for intra-operative cholangiography decreased. An adverse reaction to the cholangiographic contrast, albeit mild, was seen in two patients in this study. This CT cholangiography had the advantage of being very accurate for the depiction of the biliary system and it could simultaneously demonstrate a biliary and hepatic vascular relationship when CT angiography had been performed as part of the same procedure.

'Real-in-one' imaging protocols for the evaluation of potential living liver donors: comparison of magnetic resonance imaging and multidetector computed tomography


BACKGROUND. This study was undertaken in order to compare the performance of all-in-one magnetic resonance imaging (MRI) and all-in-one MDCT in the pre-harvest evaluation of liver transplant donors. Twenty-five potential living donors underwent both MRI (1.5 T) and four-row MDCT. Both scan protocols included angiography of the arterial and venous hepatic systems. The CT additionally included infusion of a biliary contrast agent. A data analysis based on source images, multiplanar reformats and three-dimensional post-processing and image quality grading was performed. An intra-operative correlation was available in 13 donors. Two candidates with CT scans presented a moderate adverse reaction to the biliary contrast agent. MRI and CT showed the same benign parenchymal lesions. The determination of liver volumes was easier based on CT scans. CT angiography was superior to MR angiography in the detection of arterial and biliary tract variants (Figs 18.5 and 18.6), whereas the detection of hepatic and portal venous variants was equally good with both modalities (Table 18.1).

INTERPRETATION. The CT and MRI findings correlated well with the intra-operative findings. The ability to assess the liver anatomy in a single diagnostic step will help to reduce the need for multimodality evaluation. This will not only relieve the medical infrastructure, but will also augment the candidate’s acceptance for a pre-transplant evaluation. Both MDCT and MRI proved to be efficient for this purpose, but the main advantage of CT lies in its ability for assessing the biliary anatomy accurately.

| Table 18.1 Living donor liver transplantation: relevant findings in living donor transplant candidates |
|-------------------------------|---------------------------------|-------------------------------|
| Hepatic arterial variants     | MRI: Fifteen in ten candidates  | CT: Eighteen in thirteen candidates |
| Portal venous variants        | Four in four candidates         | Four in four candidates        |
| Hepatic venous variants       | Four in four candidates         | Four in four candidates        |
| Intra-hepatic biliary variants| Four in four candidates         | Four in four candidates        |
| Hepatic lesions               | Four in four candidates*        | Four in four candidates*       |
|                              |                                 |                               |
| aOne adenoma, one haemangiom and two cysts. (Source: Schroeder et al. (2005)). |
Comment

A thorough pre-operative evaluation of the hepatic parenchyma and a detailed study of the vascular and biliary anatomy is a prerequisite to living related donor transplants so as to minimize the risks of vascular and biliary complications. MDCT is considered excellent for evaluation of the vascular anatomy; however, it was not routinely used for evaluating a non-dilated biliary system. If CT angiography and CT cholangiography can be performed as a single test, this will greatly reduce the eventual cost of the procedure. The authors performed four-row MDCT 30 min after the infusion of a biliary contrast agent displaying the biliary tree at least up to the third level of the intra-hepatic branches. MDCT cholangiography permitted visualization of up to the fourth-order biliary branches and the variant anatomy, which was more accurate than the findings at magnetic resonance cholangiopancreatography (MRCP). Two patients experienced a moderate reaction to the biliary contrast agent, which resolved soon after administration of standard anti-histaminic treatment. The ‘in-room’ examination time for CT angiography and MDCT cholangiography was slightly, although not significantly, less than MRI.

MDCT cholangiography with volume rendering for the assessment of patients with biliary obstruction


BACKGROUND. In this study the investigators attempted to evaluate the diagnostic utility of MDCT cholangiography with volume rendering in the evaluation of patients with suspected biliary tree obstruction. Thirty-four patients with biliary obstruction had portal venous phase MDCT scans. No cholangiographic contrast agent was administered. Three-dimensional MDCT cholangiographic images were produced using volume rendering. Overall, 26 of the 34 patients had ERCP and five had percutaneous transhepatic cholangiography (PTC) correlation.
Seventeen patients underwent biopsy or surgery. Microlithiasis could not be detected on MDCT cholangiography in one patient. One patient with polypoid adenocarcinoma and one patient with normal findings were incorrectly diagnosed with biliary stones on the basis of MDCT cholangiography. The stricture was incorrectly diagnosed as malignant in one out of two patients with a benign stricture. The sensitivity of MDCT cholangiography was 93% and the specificity was 89% for biliary stone (Figs 18.7 and 18.8) and both were 94% for malignant biliary obstruction. The accuracy of the technique for the diagnosis of the cause of biliary obstruction was 83.3%.

**INTERpretation.** MDCT cholangiography with volume rendering is a non-invasive and fast imaging technique with high sensitivity and specificity for the diagnosis of biliary tree obstruction. It is a promising diagnostic tool, which can be used for evaluation of biliary obstruction when MRCP cannot be performed.

**Comment**

Accurate and early diagnosis is crucial to selecting the appropriate therapy in patients with suspected biliary obstruction. Invasive procedures such as ERCP and PTC allow direct visualization of the biliary tree and simultaneous intervention and, hence, these are considered as gold standards. CT cholangiography is dependent on excretion of the biliary contrast agent, which in turn is dependent on liver function. It cannot be performed in patients with raised bilirubin levels. In this study, the CT cholangiography was performed without the administration of a biliary contrast agent. Portal venous phase data acquisition was performed. Volume rendering was used for producing MDCT cholangiography images. The rendering parameters used were a window level from -20 to -40 H and a window width setting from -200 to -250 H. These parameters resulted in biliary ducts being seen as hyperdense, while the other hyperdense structures such as the vasculature and bones were eliminated.

The study was accurate for the detection of biliary duct stones: however, it has limitations in the detection of microlithiasis. Due to the absence of pre-contrast imaging, tumour masses that protrude into the lumen may be mistaken for stones. The sensitivity for the detection of malignant obstruction was very high: however, accurate differentiation of benign from malignant lesions is difficult.

**Ferucarbotran-enhanced MRI versus triple-phase MDCT for the preoperative detection of hepatocellular carcinoma**


**BACKGROUND.** The authors compared ferucarbotran-enhanced MRI with triple-phase MDCT for the pre-operative detection of hepatocellular carcinoma. Seventy-three consecutive patients (121 hepatocellular carcinomas) underwent ferucarbotran-enhanced MRI, including a dynamic study and triple-phase MDCT before hepatic resection. Surgical confirmation was available in all patients. The accuracy of these techniques for the detection of hepatocellular carcinoma was assessed by conducting a receiver operating characteristic analysis of the observations of 88 resected hepatic segments with at least one hepatocellular carcinoma each and 121 resected hepatic segments without hepatocellular carcinoma. The mean sensitivities of MRI and triple-phase MDCT were 90.2 and 91.3%, respectively and their mean specificities were 97.0 and 95.3%, respectively, which was not statistically significant.

**INTERpretation.** Ferucarbotran is a super-paramagnetic iron oxide material that is taken up by the Kupffer cells of the liver resulting in loss of signal intensity in normal liver tissue. The abnormality was seen as a high signal intensity area in this study. Ferucarbotran-enhanced MRI is as accurate as triple-phase MDCT for the pre-operative detection of hepatocellular carcinoma (Fig. 18.9). This technique may be used for the detection of hepatocellular carcinoma when the results of MDCT are equivocal.
Comment
The imaging diagnosis of hepatocellular carcinoma is accurately made on the basis of triphasic CT scans, which is the most commonly performed technique for hepatocellular carcinoma detection. The authors compared triple-phase MDCT with ferucarbotran-enhanced MRI in this study. Ferucarbotran is an MRI contrast agent that allows both dynamic imaging as well as liver-specific delayed imaging due to its uptake by the Kupffer cells in the hepatic parenchyma. The authors observed that both MDCT and ferucarbotran-enhanced MRI were equally accurate for hepatocellular carcinoma detection. Ferucarbotran-enhanced MRI is not very sensitive in moderate to poorly differentiated hepatocellular carcinomas since some residual Kupffer cell activity may be present in such lesions. Both MDCT and ferucarbotran-enhanced MRI are not sensitive for the detection of lesions smaller than 1.2 cm. The authors were of the opinion that the use of ferucarbotran-enhanced MRI should be performed when MDCT findings are equivocal.

Capability of multidetector CT to diagnose hepatocellular carcinoma-associated arterioportal shunt

Background. The aim of this study was to investigate the capability of MDCT for diagnosing hepatocellular carcinoma-associated arterioportal shunts. Triphasic MDCT and digital subtraction (DS) angiography examinations were performed in 282 patients with hepatocellular carcinoma. The images were analysed jointly by two experienced radiologists blinded to the opposite examination results, including the existence or not of arterioportal shunts, shunt locations and the types and degrees of arterioportal shunts, with or without thrombosis. There were 56 arterioportal shunts associated with hepatocellular carcinoma: 48 out of 56 were central, seven out of 56 were peripheral and one out of 56 was mixed or 42 out of 56 were severe, seven out of 56 were moderate and seven out of 56 were mild arterioportal shunts. Forty-one severe, and seven moderate and central arterioportal shunts were all revealed with MDCT and DS angiography. Seven mild and peripheral arterioportal shunts were all displayed with MDCT: only five of them were displayed on DS angiography, while two faint shunt arterioportal shunts associated with massive hepatocellular carcinoma were missed. One mixed arterioportal shunt was demonstrated as severe combined with mild shunt with both MDCT and DS angiography. MDCT could diagnose not only DS angiography-revealed arterioportal shunts, but also the mild and peripheral arterioportal shunts that were missed with DS angiography (Fig. 18.10).

Interpretation. MDCT is a simple, effective and non-invasive new technique for the diagnosis of hepatocellular carcinoma-associated arterioportal shunts. Triphasic imaging provides accurate visualization of shunts and allows differentiation from perfusion defects and other vascular lesions.

Comment
The inadvertent embolization of chemotherapeutic agent into normal hepatic parenchyma can be better tackled if there is a convincing demonstration of arterioportal shunts on pre-procedure imaging. In this study, triphasic MDCT was performed and the authors observed that it was more sensitive than conventional angiography for the detection of mild peripheral shunts. Conventional catheter angiography provides accurate assessment of large and moderate arterioportal shunts, but it cannot differentiate arterioportal shunts from haemangiomas or perfusion defects seen in cirrhosis due to a lack of associated parenchymal imaging. The simultaneous acquisition of multiple vascular phases and the
Detection of liver metastases under 2 cm: comparison of different acquisition protocols in four row multidetector-CT (MDCT)


**BACKGROUND.** This study compared different acquisition protocols’ performance in detecting small liver metastases (<2 cm). Thirty consecutive patients with histologically proven hepatic metastases were explored by MDCT at the liver equilibrium phase by four successive acquisitions. The authors compared the following four protocols: (1) 5/30/1.5 (section thickness/table speed/pitch), (2) 5/15/0.75, (3) 5/11.25/0.75 and (4) 2.5/15/1.5, with the same X-ray dose. The gold standard was based on patient radiological follow-up. Evolutive lesions were considered as true positives. The described lesions, which were not found on the follow-up examinations despite tumour progression, were considered as false positives. Stable lesions could not be considered as metastases and were eliminated. A total of 176 lesions were detected: 61 were true positives, 91 were false positives and 24 lesions were eliminated. The results of protocols 2 and 3 were significantly superior to those of protocols 1 and 4 (Fig. 18.11).

**INTERPRETATION.** An increased table speed and thinner slice collimation does not result in improved detection of small (<2 cm) metastases (Fig. 18.12). In this study, MDCT protocols using thin sections or an increased table speed were observed to be less efficient in detecting small metastases.

**Fig. 18.10** Massive pattern of hepatocellular carcinoma associated with mild and peripheral arterioportal shunts. (a) Transient wedge-shaped enhancement anterior to hepatocellular carcinoma foci at the late hepatic arterial phase, (b) becoming isodensity at the portal vein phase: a decreased-enhancement degree of hepatocellular carcinoma focus was also disclosed. The arterioportal shunt was missed with DS angiography (not shown). Source: Luo et al. (2005).

**Fig. 18.11** Receiver operating characteristic curves for the four acquisition protocols. The areas under the receiver operating characteristic curves were always greater than 0.7, showing good diagnosis accuracy for the four imaging protocols. However, the areas under the receiver operating characteristic curves were higher for protocols 2 and 3, with a statistically significant difference compared to protocols 1 and 4. Source: Abdelmoumene et al. (2005).

**Fig. 18.12** Slices obtained at the same level for protocols 1–4. Artefacts in the left lobe are observed in protocol 1 (arrow). The images produced by protocols 2 and 3 were of similar quality, in particular for the detection of lesions in segment 7, which were barely visible in the images from protocol 4. Source: Abdelmoumene et al. (2005).
INTERPRETATION. Image reconstruction with MD-row helical CT at different collimations (difference was noted in the conspicuity of lesions at statistically significant (P = 0.01). However, no significant difference was noted between collimations in the pooled sensitivity for metastatic lesions (P > 0.99). No statistical difference was noted in the conspicuity of lesions at different collimations (P = 0.18).

BACKGROUND. This study was performed in order to determine the value of collimations <5.0 mm in detecting hepatic metastases 1.5 cm or smaller by using MDCT. Thirty-one patients underwent contrast material-enhanced MDCT before hepatic resection in this prospective study. Images were reconstructed at collimations of 5.00, 3.75 and 2.50 mm with 50% overlap and reviewed independently by three radiologists. Each lesion was characterized as metastatic, benign or equivocal and graded for conspicuity. The criterion standards were pathological assessment of the resected liver and follow-up of the non-resected liver. The authors observed that reducing the slice thickness to 2.5 mm does not improve lesion detection. The lower efficiency of thinner sections in detecting small lesions may be attributed to the geometric efficiency of the detectors that decreases with thin collimation. In addition, a decreasing slice thickness resulted in an increase in image noise and a decrease in image quality. The outcome of increasing the table speed (and, thus, the pitch) was not beneficial, since it resulted in an increase in the artefacts in the image. This translated into a poor image quality. Thus, the optimization of MDCT protocols is a critical prerequisite to achieving good image quality and, thus, improving the detection of small tumours.

Multidetector row helical CT in preoperative assessment of small (1.5 cm) liver metastases: is thinner collimation better?

COMMENT
There is a tendency to think that, with the availability of scanners that allow increased table speeds and slices with submillimetre thicknesses, this will result in a better image quality and improve the diagnostic yield. Even with the availability of MDCT scanners, the detection of small lesions remains a challenge. The authors performed MDCT in 30 patients using four different imaging protocols. These protocols aimed to assess the effect of table speed and slice thickness on the sensitivity of detecting lesions smaller than 2 cm. The authors observed that reducing the slice thickness to 2.5 mm does not improve lesion detection. The lower efficiency of thinner sections in detecting small lesions may be attributed to the geometric efficiency of the detectors that decreases with thin collimation. In addition, a decreasing slice thickness resulted in an increase in image noise and a decrease in image quality. The outcome of increasing the table speed (and, thus, the pitch) was not beneficial, since it resulted in an increase in the artefacts in the image. This translated into a poor image quality. Thus, the optimization of MDCT protocols is a critical prerequisite to achieving good image quality and, thus, improving the detection of small tumours.

Comment
Newer developments in MDCT require the use of optimized imaging protocols and appropriate parameters. Modifications in detector collimation, table speed and pitch can be performed in order to achieve an excellent quality of images. However, this has a threshold beyond which there is, in fact, deterioration of the images. In this study the reduction in collimation did not improve the detection of metastatic lesions smaller than 1.5 cm. Detecting more benign lesions while not detecting more malignant lesions at thinner collimation would not be of great clinical value. The authors found that there was no trend towards improved characterization, as the number of overcalled lesions and the number of misclassified lesions did not decrease. Thus, a reduction in collimation without improved lesion characterization for small lesions is not of clinical significance.

Conclusion
MDCT represents a major breakthrough in CT technology. In recent years there has been a paradigm shift in imaging techniques. MDCT has created new opportunities such as three-dimensional imaging, CT angiography and CT cholangiography. The short scan times have enabled multiphasic imaging that has resulted in better lesion detection and characterization. MDCT has replaced invasive procedures such as cather angiography and ERCP for evaluation of the hepatobiliary system. MDCT cholangiography has challenged MRCP and has proved to be better for peripheral biliary tree visualization. MDCT has revolutionized imaging of the liver for pre-operative purposes. Three-dimensional imaging and image manipulation techniques have given the surgeon greater confidence to tackle more complex anatomic structures and has thus improved patient selection. There are still limitations in the diagnosis and characterization of small parenchymal lesions (<1.5 cm). With newer scanners and more advanced technology, there are new challenges to be dealt with. Protocol optimization is critical for permitting the best use of the available technology. A vast array of clinical and research opportunities are being created by the gamut of examinations now possible with the newer generation MDCT scanners. This is a very rapidly developing technology and it is up to us to take up the challenge.
References


