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## Incidence of 'Incidentalomas' in over 100 consecutive CT angiograms for preoperative DIEP flap planning

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### KEYWORDS

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**Summary** The gold standard in breast reconstruction is the deep inferior epigastric perforator (DIEP) flaps, although muscle-sparing transverse rectus abdominis myocutaneous (TRAM) flaps are still being performed due to variations in the abdominal vasculature and to reduce flap complications. Recently, there has been a rise in interest in preoperative imaging, in particular, by means of computer tomography angiogram (CTA). CTA has been shown to delineate the vascular anatomy, improve preoperative decision making and possibly reduce operating time and constitutes a routine preoperative investigation in our unit.

Of the 104 consecutive patients who had undergone CTA prior to breast reconstruction, we have found a 13% incidence of unexpected findings or 'incidentalomas' in otherwise asymptomatic women. None were malignant, but changes to the initial operative plan included deferring immediate breast reconstruction, further surgery and further investigations for these incidentalomas.

We recommend that all women are counselled of the possibilities of incidentalomas prior to CTA. Furthermore, clinicians need to be receptive to the possibility of a delayed or alternative reconstruction, and closely liaise with other specialties to avoid damage to the deep inferior epigastric vasculature.

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Following the evolution of the free abdominal flap from transverse rectus abdominis myocutaneous (TRAM) to muscle-sparing TRAM (MS-2) to deep inferior epigastric perforator (DIEP) flap for breast reconstruction,<sup>1–5</sup> there has been a rise in interest in preoperative imaging.<sup>6–8</sup>

Imaging primarily aims to delineate the anatomy of the perforating vessels as accurately as possible, improving preoperative decision making and the surgeon's familiarity with the individual patient's anatomy with the potential to reduce operating time.<sup>6–11</sup> Indeed, recent studies have shown the accuracy of preoperative investigation in the form of a fine-cut computer tomography angiogram (CTA) to be so good that some have suggested its use for preoperative assessment before performing DIEP flap breast reconstruction.<sup>8</sup> What is certainly becoming more widely recognised is the value of preoperative CTA in those patients who have undergone previous abdominal or gynaecological surgery.

In our unit, it is now a routine practice for all patients undergoing abdominal flap breast reconstruction to have a preoperative CTA. Majority of patients having this investigation have not had previous abdominal surgery. We noticed that a proportion of otherwise healthy and asymptomatic women had intra-abdominal pathology diagnosed on the scans. We have now performed over a 100 consecutive CTA on women undergoing abdominal flap breast reconstruction (immediate and delayed). The purpose of this study was to analyse the incidence of unexpected findings or so-called 'incidentalomas' in our patient population, with a view to establishing whether any further advice and counselling should be recommended to this patient group.

## Patients and methods

All consecutive patients who were due to undergo either immediate or delayed breast reconstruction between January 2007 and April 2008 were included in this study. These patients underwent preoperative CTA of their abdomen and pelvis. In our unit, a 32-slice computer tomography (CT) scanner is used. A 100 ml of iodinated contrast is administered at 4 ml s<sup>-1</sup> to produce a CTA from the level of the diaphragm to the femoral heads, and images are acquired at 0.625 mm to allow full reconstruction. All scans and reports are archived on picture archiving and communication system (PACS). The radiology reports were reviewed and the details of any unexpected findings were recorded. In patients with incomplete or absent reports, the scans were then re-reviewed by a consultant radiologist. Case notes were then retrieved for those patients who were found to have incidentalomas and their subsequent clinical course and outcome were recorded. The results below are additionally illustrated by the inclusion of two patients' case reports.

## Results

A total of 104 consecutive patients of an average age of 51 years (range: 22–69) underwent preoperative CTA to facilitate the planning of free abdominal flap breast reconstruction. There were no adverse events associated with the administration of iodinated contrast. The types of reconstruction performed are summarised in Table 1. A total of 13 (13%) were found to have incidentalomas (see Table 2). Although no lesion was ultimately found to be malignant, one patient underwent a nephrectomy for a suspected renal cell carcinoma delaying her subsequent

**Table 1** Details of type of reconstruction in our cohort of patients.

Type of Reconstruction	No. of patients	
Breast reconstruction	Delayed free flap	69
	Immediate free flap	20
	Latissimus dorsi flap and implant	1
	Implant only	3
	Unknown	8
Face reconstruction		1
Cancelled	Medically unfit	1
	Subsequent metastatic disease	1
<b>Total</b>	<b>104</b>	

breast reconstruction by 4 months. A further six patients required further investigation in the form of ultrasound or magnetic resonance imaging (MRI) to confirm a benign diagnosis. Benign liver lesions were most commonly encountered and further details of incidental lesions are shown in Table 2.

The following two case reports provide examples of the clinical scenarios encountered.

### Case 1

A 56-year-old female diagnosed with unilateral ductal carcinoma *in situ* (DCIS) was scheduled for mastectomy and immediate breast reconstruction with a DIEP flap. A CTA demonstrated an incidental 4.8-cm mass in the upper pole of the left kidney with heterogeneous density and a large amount of central fat (Figure 1). The differential diagnosis was either an angiomyolipoma or a renal cell carcinoma. The patient thus underwent mastectomy with a delayed-immediate reconstruction using only expander.<sup>12</sup> She was then referred for a urological opinion. The urology multi-disciplinary team could not exclude malignancy on the basis of the CT appearances alone. Furthermore, due to the size of the mass, a nephrectomy was recommended. The histological diagnosis proved to be an angiomyolipoma. Microsurgical reconstruction of the breast was delayed by 4 months as a result of this incidental finding, and the nephrectomy was performed laparoscopically leaving two small port scars on the left side of the lower abdomen. Breast reconstruction with a DIEP flap was successfully achieved, but the position of the laparoscopy scars obligated the use of the right-sided deep inferior epigastric artery system despite the initial finding of a dominant left deep inferior epigastric system.

### Case 2

A 50-year-old female with previous mastectomy for DCIS had a left adrenal mass identified on CTA prior to a scheduled DIEP flap breast reconstruction. This lesion measured 2.9 cm in diameter, and it was not possible to exclude malignancy on the basis of CT appearances (Figure 2). The patient subsequently had an MRI scan which reported the

**Table 2** Details of incidental lesions found in our cohort of patients.

Incidentaloma		No. of patients	Further investigations/ treatment	Outcome
Hepatobiliary	Benign cyst	3	Ultrasound scan	No delay in reconstruction
	Haemangioma	2	Ultrasound scan	No delay in reconstruction
	Benign mass	2	None	No delay in reconstruction
	Gallstones	1	None	No delay in reconstruction
Splenic	Splenic cyst	1	None	No delay in reconstruction
Renal	Angiomyolipoma	1	Nephrectomy	See case report 1. Reconstruction delayed 4 months
Adrenal	Cortical cyst	1	None	No delay in reconstruction
	Adrenal mass	1	MRI	See case report 2. Yearly CT scan for monitoring. No delay in reconstruction
Pelvic	Uterine dermoid cyst	1	None	No reconstruction as subsequent diagnosis of metastatic disease

adrenal mass to be 'in keeping with an adrenal cyst'. A general surgical opinion was sought, and the patient was recommended for interval CT scanning. She then underwent DIEP flap breast reconstruction which was delayed by approximately 1 month due to the incidental finding.

## Discussion

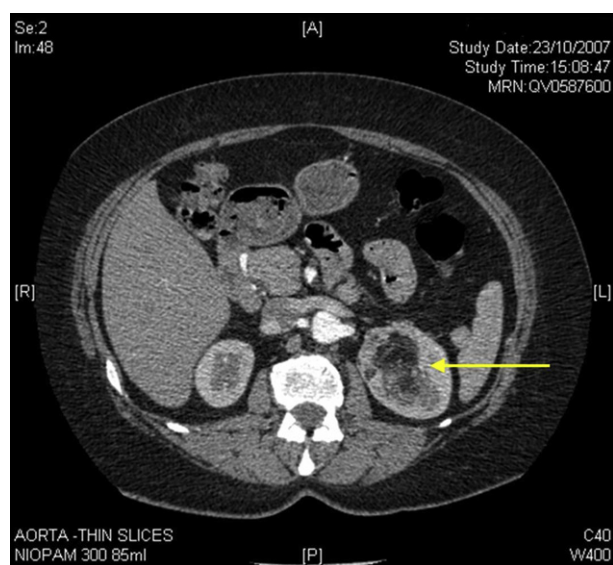
The CTA appears to be becoming the gold standard of preoperative perforator mapping for abdominal flap breast reconstruction, with a 100% concordance between CTA and intra-operative findings (96% sensitivity and 95% specificity).<sup>13</sup> Furthermore, the superiority of CTA over other imaging modalities, namely Doppler ultrasound, has been demonstrated.<sup>14</sup>

In our series, 13% of the patients were found to have previously undiagnosed intra-abdominal pathologies, the

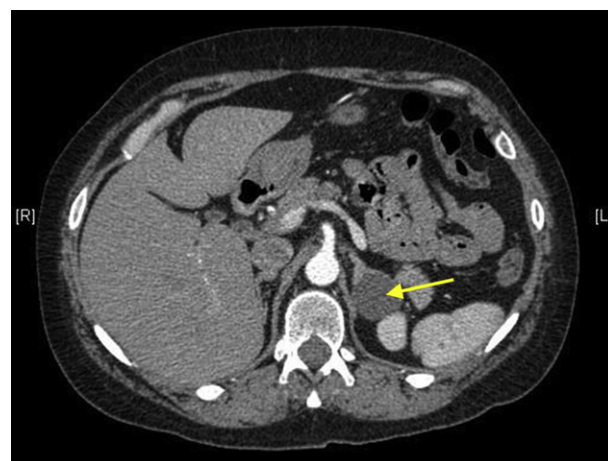
so-called incidentalomas. Meaningful comparison between previous studies in the literature on the rates of incidentalomas are difficult to make due to variations in patient population, use of contrast and interpretation of the severity of the CT findings.

In the emergency department, spiral CT performed on trauma patients revealed an incidence of 9% (90 out of 991 patients) of clinically significant findings in the abdomen and pelvis.<sup>15</sup> Interestingly, this study demonstrated that there were more incidentalomas in women aged above 40 years and occurring more within the abdomen and pelvis compared to the rest of the body. This is comparable to our findings in a similar cohort of patients. In a study on the incidental findings found on planning CT scans for breast and chest wall irradiation for breast cancer, an incidence of 11% was found, with 3% of additional foci of malignancy, resulting in the change of treatment, either deferring radiotherapy or altered dose of radiotherapy.<sup>16</sup>

However, much higher incidences of unexpected findings were found in other studies. These studies involved either a 'normal' population or a group of patients at risk of colonic malignancies. In a study of patients presenting with renal calculi to the emergency department, 45% of the



**Figure 1** A CT image of Case 1 demonstrating a 4.8-cm mass within the parenchyma of the upper pole of the left kidney (arrow). This patient subsequently underwent a nephrectomy delaying her breast reconstruction by 4 months. [A] = anterior, [P] = posterior, [R] = right and [L] = left.



**Figure 2** A CT image of Case 2 demonstrating the left adrenal mass (arrow), which was later confirmed to be in keeping with an adrenal cyst on MRI. [R] = right and [L] = left.

scans demonstrated incidental findings, although only 21% of the findings were initially documented.<sup>17</sup> In contrast, a comprehensive review of the literature of incidental findings in CT colonography revealed an average incidence of 40%. Although a majority of the studies reviewed were carried out prospectively for the diagnosis of colonic polyps or cancers, 2.7% of the cases had extracolonic cancers and 0.9% had aortic aneurysms.<sup>18</sup>

A comparable patient population to the otherwise fit and well breast cancer patient are possibly those undergoing CT scanning offered by some insurance companies as part of health screening for the 'worried well'. There is no published medical literature on the prevalence of incidentalomas in this population, and four major UK medical insurance companies that we contacted either claimed not to have any data or were unwilling to share their data with us.

The benefits of CTA are clear in that it accurately delineates the anatomy of the perforating vessels, thereby enabling preoperative decision making, increasing surgeon comfort in the operating theatre, and offers the potential to reduce operating time. In routine CTA, it may be possible to detect incidental findings of potentially life-threatening conditions such as abdominal aortic aneurysms or other malignancies. These are detected earlier, thereby reducing potential morbidity and mortality associated with late detection. On the other hand, incidental findings of moderate-to-low importance pose clinical management dilemmas. Such findings in otherwise asymptomatic women inevitably prompt further anxiety, investigations as well as additional costs. Furthermore, studies in the United Kingdom have shown that an estimated 0.6% cumulative risk of cancer up to the age of 75 years in both men and women are caused by diagnostic X-ray.<sup>19</sup> Meanwhile, in the United States, 0.4% of all cancers from 1991 to 1996 were attributable to CT scanning. By adjusting this estimate for current use, this estimate might now be in the range of 1.5%–2%.<sup>20</sup>

What are the overall implications of our findings? We feel there are four main areas highlighted by our results:

1. We now recommend that all patients are counselled that there is a 1:10 chance of an unexpected finding on CTA unrelated to their breast cancer.
2. A degree of flexibility in time management or planning of those patients undergoing delayed reconstructions must be allowed for in case an incidentaloma being discovered.
3. In patients whereby an immediate free-flap reconstruction is scheduled, we would recommend a preoperative CTA. This allows us to pre-empt the need for any further treatment unrelated to breast cancer when an incidentaloma is discovered. In such cases, a delayed-immediate reconstruction by means of a tissue expander is indicated.
4. Close discussion and co-operation with other specialties is highly recommended to minimise the risk of damage to the deep inferior epigastric vasculature should the patient need to undergo other surgical procedures. If there is a suspicion of injury to the deep inferior epigastric artery, the CTA should be repeated or another reconstruction option should be chosen.

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## Conflict of interest statement

None.

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None.

## Ethical approval

We have sought advice from the Local Ethics Committee and have been advised that as our study is a retrospective study, of which the results do not affect patient management, it was deemed unnecessary for formal ethics approval.

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