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## Review

# Perforator mapping reduces the operative time of DIEP flap breast reconstruction: A systematic review and meta-analysis of preoperative ultrasound, computed tomography and magnetic resonance angiography



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### KEYWORDS

Breast reconstruction;  
DIEP;  
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Review

**Summary Background:** Prior to DIEP flap breast reconstruction, mapping the perforators of the lower abdominal wall using ultrasound, computed tomography angiography (CTA) or magnetic resonance angiography (MRA) reduces the risk of flap failure. This review aimed to investigate the additional potential benefit of a reduction in operating time.

**Methods:** We systematically searched the literature for studies concerning adult women undergoing DIEP flap breast reconstruction, which directly compared the operating times and adverse outcomes for those with and without preoperative perforator mapping by ultrasound, CTA or MRA. Outcomes were extracted, data meta-analysed and the quality of the evidence appraised.

### Ethical review

Ethical review was not required as this is a review of published literature. Further, this article does not contain any studies with human participants, which were originally performed by any of the authors.

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**Results:** Fourteen articles were included. Preoperative perforator mapping by CTA or MRA significantly reduced operating time (mean reduction of 54 minutes [95% CI 3, 105],  $p = 0.04$ ), when directly compared to DIEP flap breast reconstruction with no perforator mapping. Further, perforator mapping by CTA was superior to ultrasound, as CTA saved more time in theatre (mean reduction of 58 minutes [95% CI 25, 91],  $p < 0.001$ ) and was associated with a lower risk of partial flap failure (RR 0.15 [95% CI 0.04, 0.6],  $p = 0.007$ ). All studies were at risk of methodological bias and the quality of the evidence was very low.

**Conclusions:** The quality of research regarding perforator mapping prior to DIEP flap breast reconstruction is poor and although preoperative angiography appears to save operative time, reduce morbidity and confer cost savings, higher quality research is needed.

**Registration:** PROSPERO ID CRD42017065012.

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## Introduction

As the incidence of breast cancer continues to rise,<sup>1</sup> more women are undergoing mastectomy and breast reconstruction.<sup>2</sup> Autologous tissue breast reconstruction offers the greatest patient satisfaction,<sup>3</sup> so its use is gaining popularity worldwide<sup>4</sup> with the deep inferior epigastric perforator (DIEP) flap evolving as the ideal choice for autologous reconstruction in suitable women. Breast reconstruction with DIEP flap(s) is associated with lower risks of adverse outcomes,<sup>5</sup> favourable donor site morbidity,<sup>6-9</sup> improved quality of life,<sup>10</sup> shorter hospital stay,<sup>11,12</sup> reduced postoperative pain<sup>13-15</sup> and superior cosmetic results,<sup>16</sup> compared to breast reconstruction using other flaps and a substantially lower risk of failure when compared to implants.<sup>5,17,18</sup>

To reduce the risk of complications and improve the efficiency of flap harvest, many surgeons use preoperative perforating mapping of the lower abdominal wall. Current options<sup>19</sup> include: duplex ultrasound; computed tomography angiography (CTA) with intravenous iodinated contrast and magnetic resonance angiography (MRA) with intravenous gadolinium. Recent reviews have shown that perforator mapping significantly reduces the risks of total and partial flap failure<sup>20</sup> as well as hospital stay.<sup>21</sup> Axial imaging with CTA/MRA also provides an opportunity to detect 'incidentalomas' or occult recurrence,<sup>19</sup> which could substantially change management.<sup>22-24</sup> Further, Offodile and

colleagues<sup>25</sup> showed that perforator mapping by CTA was cost-effective given morbidity reductions and improved quality of life when compared to DIEP flap breast reconstruction without preoperative imaging, which is associated with higher risks of complication. However, to-date there is no reliable evidence that perforator mapping reduces operating time. Reducing operating time has the potential to confer considerable cost-savings, reduce morbidity and therefore, improve patient outcomes.

We aimed to investigate the hypothesis that preoperative perforator mapping by ultrasound, CTA or MRA prior to DIEP flap breast reconstruction, reduces operating time.

## Methods

This review is registered on the PROSPERO database (CRD42017065012); it was designed and conducted in accordance with the Cochrane Handbook of Systematic Reviews<sup>26</sup> and has been authored in accordance with the PRISMA checklist.<sup>27</sup>

## Search strategy

Both Medline and EMBASE were interrogated by two independent authors, using the NICE Healthcare Database (<https://hdas.nice.org.uk/>) and the terms DIE?P.ti,ab OR

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