

# Coronary artery bypass surgery: current practice in the United Kingdom

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**ABSTRACT** A survey of current clinical practice was carried out among the 84 consultant cardiac surgeons currently performing coronary artery bypass surgery in the United Kingdom. The 80 surgeons who returned the questionnaire performed an estimated total of 17 100 coronary artery bypass graft operations in 1987, a mean case load of 214 operations each. Sixty two of the 80 surgeons regarded the internal mammary artery as the graft conduit of choice, and seven preferred the saphenous vein. The internal mammary artery was used in 73% of bypass grafts to the left anterior descending coronary artery but in only 4% of grafts to the circumflex and right coronary systems. Contraindications to the use of the internal mammary artery included advanced age of the patient (51 surgeons), insufficient flow through the internal mammary artery (49), and endarterectomy (35). Seventy four of the 80 surgeons considered intraoperative damage to the saphenous vein to be a possible cause of vein graft failure, but there was no agreement about how it should be reduced. All surgeons advocated pharmacological measures to enhance graft patency. Dipyridamole and aspirin constituted the most popular regimen (58 surgeons), though only 28 started dipyridamole preoperatively. Warfarin was prescribed postoperatively on occasion by 22 surgeons, but 14 of these used it only after endarterectomy.

## Introduction

Coronary artery bypass surgery is one of the most commonly performed surgical procedures in the United Kingdom; more than 10 600 such operations were carried out within the National Health Service in 1985.<sup>1</sup> It is highly effective in relieving angina in most patients, and has been shown to prolong life in certain groups of patients.<sup>2-4</sup> The long term benefit of the operation depends, however, on continued patency of the bypass graft, as graft occlusion is a major cause of recurrence of symptoms, often leading to repeat operations.<sup>5,6</sup>

Several factors, both intraoperative and postoperative, have been shown to be important for long term graft patency,<sup>7</sup> and the choice of graft conduit is paramount.<sup>8-10</sup> Retrospective studies have shown that internal mammary artery grafts have much better long term patency than saphenous vein grafts, and are

associated with less recurrence of angina and need for reoperation, fewer sudden cardiac events, and significantly improved survival.<sup>8-10</sup> The use of the internal mammary artery is limited, however, by lack of sufficient material for multiple grafting. Because of the relatively poor patency rates of synthetic conduits,<sup>11</sup> saphenous vein continues to be widely used.

Inadvertent damage to graft endothelium and media during surgical preparation may be an important determinant of early and late graft occlusion, particularly in vein grafts.<sup>12-16</sup> Early thrombosis may be initiated by platelet adhesion and activation resulting from exposure of the basement membrane,<sup>16-18</sup> and early vein graft occlusion is reduced by antiplatelet treatment, started before or very soon after grafting.<sup>17,19</sup>

This survey was designed to investigate the practice and attitudes of British cardiac surgeons to the choice of graft conduit and methods used to increase early and late patency.

## Methods

A postal questionnaire was sent in December 1987 to all 84 consultant cardiac surgeons practising coronary

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artery bypass surgery in the United Kingdom. Closed questions were asked about their use of the internal mammary artery and perceived contraindications to its use, the techniques used for surgical preparation of saphenous vein grafts, and the actual use of pharmacological agents to enhance vein graft patency in the 12 months before the survey (questionnaire available from GDA on request). We analysed data from the 80 questionnaires (95% returned by 1 March 1988).

## Results

The 80 surgeons who participated in this survey performed an estimated total of 17 100 coronary artery bypass operations in 1987 (whether conducted within the National Health Service or privately was not specified). The distribution of case load among the surgeons is shown in figure 1. The mean case load was 214 procedures per surgeon, with a range of 44–642.

The internal mammary artery was regarded as the conduit of choice for coronary artery bypass grafting by 62 surgeons (78%) and the saphenous vein by seven, none favouring synthetic conduits; 11 had no preference. Surgeons preferring the saphenous vein tended to be those performing fewer operations but this relation was not significant. All but one surgeon had used the internal mammary artery as a single graft and 35 of the 80 had used it as a sequential graft. Both arteries had been used for grafting in the same patient

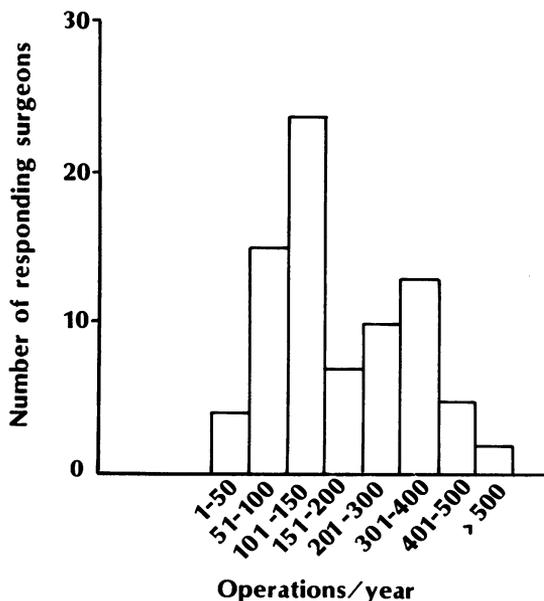


Fig 1 Number of operations performed in 1987 (total 17 100) by each of the 80 responding surgeons.

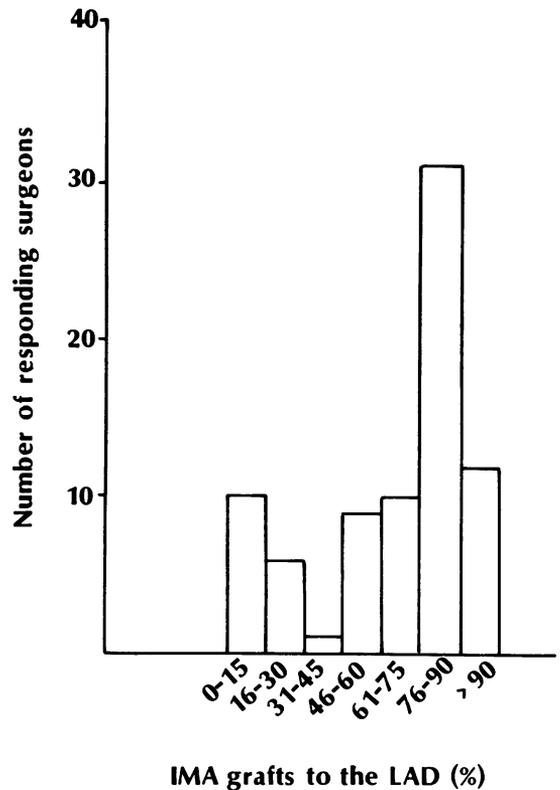


Fig 2 Percentage of left anterior descending artery (LAD) grafts made with the internal mammary artery (IMA) by each responding surgeon.

by 47 surgeons, but 31 of these stated that this was only in rare instances.

For left anterior descending artery grafts the internal mammary artery was used in 12 483 operations (73%) and 12 of the 80 surgeons used it in more than 90% of cases (fig 2). The internal mammary artery was used much less frequently for grafts for the circumflex and right coronary artery—on average in only 4% of operations in both cases. There was no significant correlation between the frequency of use of the internal mammary artery for grafts to the left anterior descending, circumflex, or right coronary systems and the number of operations performed by a surgeon.

Surgeons' views of potential contraindications to the use of internal mammary artery are summarised in the table. Each of the potential contraindications was quoted less frequently by surgeons who performed more grafts with the internal mammary artery. Unsatisfactory flow through the internal mammary artery was regarded by 49 of the 80 surgeons as a contraindication to its use, though only 20 actually measured flow quantitatively before grafting.

*Potential contraindications to the use of the internal mammary artery: summary of surgeons' views*

Contraindication	No (%) of responding surgeons
Age	51 (64)
> 60 years	7 (9)
> 70 years	39 (49)
> 80 years	5 (6)
Insufficient flow through the internal mammary artery	49 (61)
Endarterectomy	35 (44)
Unstable angina	28 (35)
Combined procedure (for example, with valve)	24 (30)
Poor left ventricular function	23 (29)
Left main coronary stem disease	15 (19)
Prolonged operation	11 (14)
Female sex	2 (3)

In relation to surgical preparation of the saphenous vein for coronary artery bypass grafting, 74 of the 80 surgeons regarded intraoperative damage as a possible cause of subsequent graft failure. Seventy seven surgeons distended the vein to relieve spasm and check side branch ligatures before grafting. Of these, only 18 made use of a pressure limiting distension device, the other 59 using uncontrolled manual distension. Harvesting of the saphenous vein was delegated to junior staff (senior house officers and registrars) by 50 surgeons; 20 usually carried this out themselves.

All surgeons routinely used some pharmacological agent to try to reduce graft failure. Aspirin was the drug most frequently used, being prescribed immediately after operation by all but eight surgeons. Among prescribers of aspirin the favoured dose was small: 38 of the 80 used 75 mg/day, 26 used 300 mg/day, and only 12 used 900 mg/day. Aspirin was continued indefinitely by 40 surgeons, but 25 discontinued it one year after operation. Dipyridamole 300 mg/day was used postoperatively by 63 surgeons, of whom 28 started it before operation and 38 discontinued it one year afterwards. The combination of aspirin and dipyridamole was used by 58 of the 80 surgeons. On occasion postoperative warfarin was prescribed by 22 surgeons, 14 of whom said that they used it only after endarterectomy and only for three months.

## Discussion

This survey of practice of coronary artery bypass surgery is the first of its kind in the United Kingdom, though similar surveys have been carried out in the United States.<sup>20-22</sup> The figure of 17 100 operations is considerably more than the 10 667 operations performed in the National Health Service during 1985,<sup>1</sup> though it includes an unspecified number performed privately.

Most surgeons share the view that the internal

mammary artery is the graft conduit of choice for coronary artery bypass grafting. Thus almost 75% of all grafts to the left anterior descending artery are now constructed from the internal mammary artery and more than half of the 80 surgeons say that they use the internal mammary artery for 80% or more of the grafts to the left anterior descending artery. In contrast, only a small percentage of grafts in the circumflex and right coronary systems are being performed with the internal mammary artery. Lefrak in 1987,<sup>20</sup> in a similar survey in the United States concerning the use of the internal mammary artery solely for left anterior descending grafts, identified a discrepancy between endorsement and use—universal endorsement of the internal mammary artery as a superior graft but far from universal application. In contrast, in our survey those surgeons who favour the internal mammary artery appear to use it in a large proportion of operations.

Among perceived contraindications to the use of the internal mammary artery, advanced patient age was cited most commonly. There is, however, no direct evidence that older patients would not benefit from an internal mammary artery graft. A few surgeons regarded unstable angina or poor left ventricular function as contraindications, suggesting that its use is being extended to those groups of patients. Clinical studies of prognosis stratified for such factors would clearly be valuable.

Our data show that use of the internal mammary artery is widespread, but largely restricted to the left anterior descending artery. In practice, it appears unrealistic to achieve complete myocardial revascularisation with internal mammary artery grafts. Currently therefore most coronary artery bypass grafts continue to be constructed with autologous saphenous vein even though this gives disappointing results as regards long term patency.<sup>5-7</sup>

Damage to the saphenous vein during surgical preparation is regarded by almost all surgeons as a potential cause of graft failure. Overdistension has been shown to damage saphenous vein<sup>12-16</sup> and most surgeons specified *careful* manual distension of the vein, though less than one quarter used a pressure limiting distension device. Concern must remain that uncontrolled manual distension, however careful, may produce unrecognised high intraluminal pressures and damage before implantation.<sup>12 14</sup> As harvesting and preparation of the saphenous vein is usually delegated to junior members of the surgical team it seems imperative that adequate instruction should be given on the importance of avoiding damage during the preparation.

Antiplatelet treatment has generated much enthusiasm in recent years and this was shared by almost all the surgeons who replied to our questionnaire. In the

study of Chesebro *et al*<sup>19</sup> greater reduction in early graft occlusion appeared to be conferred by starting dipyridamole before operation. In practice, only a third of surgeons followed such a regimen. Though oral anticoagulants have been shown to reduce early graft occlusion,<sup>23</sup> they were rarely used and then only after endarterectomy. This may reflect the surgeon's concern for control of postoperative coagulation and avoidance of bleeding problems.

The results of this survey indicate therefore, firstly, that there is a consensus of opinion among British cardiac surgeons that the internal mammary artery is the graft conduit of choice, though its use is mainly restricted to the left anterior descending artery; nearly all grafts to the circumflex and right coronary artery systems continue to be autologous saphenous vein; intraoperative damage to saphenous vein was accepted by almost all surgeons as a possible cause of graft failure. Almost all surgeons advocate postoperative antiplatelet treatment to reduce vein graft occlusion, dipyridamole and aspirin being the favoured regimen.

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