Dangers in the use of staplers in liver surgery

ANGELA RIGA, NARIMAN KARANJIA

Regional Hepato-Pancreatico-Biliary Unit for Surrey and Sussex, The Royal Surrey County Hospital, Guildford, Surrey, UK

ABSTRACT

The use of endoscopic vascular staplers has become common practice in recent years both in open and minimally invasive surgery. The technological advances, however, are not free of problems. In our practice, we have come across two cases where the Endopath ETS Flex 45 Endoscopic Articulating Linear Cutter failed with dangerous consequences.

KEYWORDS

Liver surgery – Staplers

CORRESPONDENCE TO

Nariman Karanjia, Consultant Hepatobiliary Surgeon, The Royal Surrey County Hospital, Egerton Road, Guildford, Surrey GU2 5XX, UK
T: +44 (0)1483 569947; F: +44 (0)1483 575029; E: nariman.karanjia@ntlworld.com

The use of endoscopic vascular staplers has become common practice in recent years both in open and minimally invasive surgery. In liver surgery, endoscopic articulating linear staplers have simplified the division of large vascular structures during hepatic resections.¹ The technological advances, however, are not free of problems. A recent review by the US Food and Drug Administration revealed 112 deaths, 2180 injuries and 22,804 malfunction reports linked to surgical staplers.² In our practice, we have come across two cases where the Endopath ETS Flex 45 Endoscopic Articulating Linear Cutter failed with dangerous consequences.

Case report 1

A 69-year-old woman with a colorectal metastasis straddling segments 2 and 4A underwent a left hemi-hepatectomy. After division of the hilar structures and completion of the parenchymal transection, the left middle vein complex was stapled with Endopath ETS Flex 45 Endoscopic Articulating Linear Cutter. The stapler fired staples which did not close and the vein was divided with catastrophic bleeding. The haemorrhage was controlled with digital pressure and the opening in the vena cava under-run with Prolene. Had the hepatic parenchyma not been fully transected, this might well have proved fatal from blood loss and air embolism as accessing the vena caval opening would have proved problematic from steric hindrance. The blood loss was 1000 ml, but transfusion was avoided and she made a full recovery. In our series of 425 consecutive liver resections, 31 other patients had left hemi-hepatectomies with a median blood loss of 250 ml.

Case report 2

A 67-year-old man with a colorectal metastasis straddling segments 4A, 8 and 7 underwent a right hemi-hepatectomy extended to segment 4A. As the lesion was high in the liver, the anterior intrahepatic approach was used to control the hilar inflow structures to the right liver. After exposing and taping the right anterior and posterior section trunks, the anterior section trunk was stapled with Endopath ETS Flex 45 Endoscopic Articulating Linear Cutter. The stapler divided the trunk without a row of staples on the proximal end leading to profuse bleeding. The ensuing haemorrhage was controlled with pressure and the anterior section trunk was oversewn with a Prolene whip stitch. The total operative blood loss in this patient was 2 l and he required a 4-unit blood transfusion, but he made a full recovery. In our series of 425 consecutive liver resections, 23 other patients had right hemi-hepatectomies extended to segment 4A with a median blood loss of 500 ml.

Discussion

Significant haemorrhage during hepatic resections for malignancy can result in increased mortality due to liver failure or acute blood loss. Reduction of operating time and intra-operative blood loss, through improved surgical techniques and increased operator experience, can significantly reduce postoperative morbidity and mortality. The use of endovascular staplers which are generally safe, quick and easy to apply have helped greatly in reducing operating time and intra-operative blood loss.

Despite the general reliability of linear cutting staplers, there is always a possibility of mechanical failure. Failure of stapling devices has been reported by other surgical specialties too. In thoracoscopic pulmonary lobectomies, two cases have been reported where the Endo-GIA 30 V3 cut, but failed to staple, the main right pulmonary artery and the left superior pulmonary vein. In both cases, the patients required urgent conversion to open thoracotomy and the vessels were successfully oversewn.⁵ Similar cases of endoscopic stapler failure have been reported again in lung surgery, in pharyngeal diverticulectomies, in laparoscopic gastric bypass surgery and experimental aortic surgery using intraluminal staplers.⁴ In 2002, Deng *et al.*⁵ reported 55 cases of laparoscopic linear cutting stapler malfunction during laparoscopic urological procedures. Of the 55 patients, 15 (27%) required open conversion to manage the problem, 8 (15%) received blood transfusions and 2 (4%) died postoperatively. Twenty-two events occurred during 19 laparoscopic donor nephrectomies (35%).⁵

Following our personal experience of the linear staplers' mechanical failure, we have changed our practice and are using the Endopath ETS Flex 45 No-Knife Endoscopic Articulating Linear Stapler, which allows the surgeon to inspect that the staples are well placed before dividing the vessel with scissors. To avoid potentially lethal situations occurring in liver resection during the division of large vascular structures, we recommend the use of no-knife linear staplers followed by division of the structure with scissors

after ensuring a secure staple line. We believe that this is even more important in patients undergoing laparoscopic liver resection where the time required for conversion to open surgery may prove fatal.

Conclusions

Despite the general reliability of linear cutting staplers, difficulties can be encountered in every step of use. In liver surgery this can potentially lead to catastrophic blood loss and death which can easily be avoided by using a no-knife linear stapler.

References

1. Wrightson WR, Edwards MJ, McMasters KM. The role of the ultrasonically activated shears and vascular cutting stapler in hepatic resection. *Am Surg* 2000; **66**: 1037–40.
2. Brown SL, Woo EK. Surgical stapler-associated fatalities and adverse events reported to the Food and Drug Administration. *J Am Coll Surg* 2004; **199**: 374–81.
3. Craig SR, Walker WS. Potential complications of vascular stapling in thoracoscopic pulmonary resection. *Ann Thorac Surg* 1995; **59**: 736–7.
4. Elkouri S, Noel AA, Gloviczki P, Karnicki K, Douglas CJ, Phelps RR *et al.* Stapled aortic anastomoses: a minimally invasive, feasible alternative to video-scopic aortic suturing? *Vasc Endovasc Surg* 2004; **38**: 321–30.
5. Deng DY, Meng MV, Nguyen HT, Bellman GC, Stoller ML. Laparoscopic linear cutting stapler failure. *Urology* 2002; **60**: 415–9.