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Comparative analysis of different transection techniques in minor and major hepatic resections: A prospective cohort study

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ABSTRACT

Background: In liver surgery different transection techniques are available without clear evidence regarding indication and advantage for each technique.
The aim of this study was to identify the most superior liver transection technique between the different techniques (stapler, water-jet and electrocautery). Comparative analyses were performed for minor and major hepatectomies.
Methods: In a single-center study, all liver resections performed between July 2007 and July 2012 were prospectively recorded and analysed.
Results: 366 liver resections were included according to predefined eligibility criteria.
No clear benefit for one particular technique in minor or major hepatectomy could be shown. Cost-effectiveness analysis revealed disadvantages for stapler-hepatectomies. However, minor hepatectomies were performed with significantly lower morbidity ($p < 0.001$), lower operating time ($p = 0.001$), fewer need of transfusion ($p < 0.0001$) and shorter ICU stay ($p = 0.001$) than major hepatectomies.
Conclusions: If possible, minor hepatectomies should be chosen. Competing techniques, selected according to surgeon's preference, revealed no significant differences in primary outcome measures.
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1. Introduction

Liver surgery is still associated with considerable morbidity. Prior to the introduction of modern transection techniques, mortality rates, mostly as a result of bleeding following liver resections, were high and frequent.[1] The reduction of intraoperative blood-loss has not only been shown to influence short term outcomes, but also long-term results.[2] It has been reported that disease-free survival after liver resection for malignancies is associated with the number of perioperative blood transfusions.[3] Biliary complications are the second most common cause of morbidity, with a 5–15% rate of biliary leakage[4] and are, interestingly, related to the number of blood transfusions.[3] To reduce the risk of complications, surgical techniques for liver transection were improved.[5] While liver transection had formerly been carried out with a scalpel or by finger fracture technique, more advanced methods are currently available.[6–8]

The most important surgical techniques generally used today for liver resection are the finger fracture or crush/clamp technique, the cavitron ultrasonic surgical aspirator (CUSA, Cavitron, Inc. Stanford, Conn., USA), the water-jet, the stapler and monopolar or bipolar electrocautery. Another sophisticated method, not yet routinely used, is radiofrequency-assisted liver resection (HABIB, Unomed, Switzerland).[9–18] Recently, different sealing devices such as ultrasound scissors and harmonic scalpels (Ultracision, Ethicon, Norderstedt, Germany), as well as the electrothermal bipolar vessel sealing system (EBVS) (LigaSure, Covidien, Germany) have gained more importance in liver surgery.[19–23]

Due to improvements in technology, morbidity and mortality rates in liver resection have decreased dramatically over the last two decades.[24] Perioperative mortality rates are reported with less than 5% and morbidity rates vary between 20 and 40%.[25–27]

Even though there are many different techniques available, the optimal transection technique is still missing. A number of studies have compared various methods, with differing results. However,

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evidence on which transection technique is in favour in regard to minor or major liver resection is not available.[28–30]

In this study, a comprehensive comparative single-center analysis of 366 liver resections was performed to identify the superior liver transection technique for minor and major hepatectomies. Comparative analyses between stapler, water-jet and electrocautery for minor hepatectomies and between stapler and water-jet dissection in major hepatectomies were performed.

2. Methods

2.1. Patients

In this single-center study, all patients' data of patients receiving a liver resection were prospectively recorded between July 2007 and July 2012 in an electronic database and analysed. Patient characteristics, pre- and postoperative treatment, laboratory values, operative procedures, intra- and perioperative data, complications, hospital stay, etc. were prospectively recorded in the database. Analysis of surgical procedures included anatomical segmentectomies, non-anatomical segmentectomies, right and extended right hemihepatectomies, as well as left and extended left hemihepatectomies.

For preoperative imaging and surgical planning, at least one computed scan was performed. Patients who received liver resections during another operation such as colorectal resection, gastrectomy, esophagectomy or pancreatectomy, were excluded from the analysis. Smallest atypical liver resections in terms of resectional biopsies during laparotomy or diagnostic laparoscopy were mostly classified as biopsies and were also excluded.

In a first assessment the whole cohort was analysed in regard to major and minor liver resection. In a second evaluation the surgical techniques used most were then compared for minor and major liver resections. A detailed overview is given in Fig. 1.

2.2. Liver transection techniques/surgeons

Transection techniques included in this analysis were stapler transection (GIA™ Autosuture™ Universal stapler, Covidien, Germany), water-jet (Hydro-Jet®, Erbe, Tuebingen, Germany) and electrocautery for minor liver resections. For major liver resections stapler transection technique (GIA™ Autosuture™ Universal stapler, Covidien, Germany) and water-jet (Hydro-Jet®, Erbe, Tuebingen, Germany) were

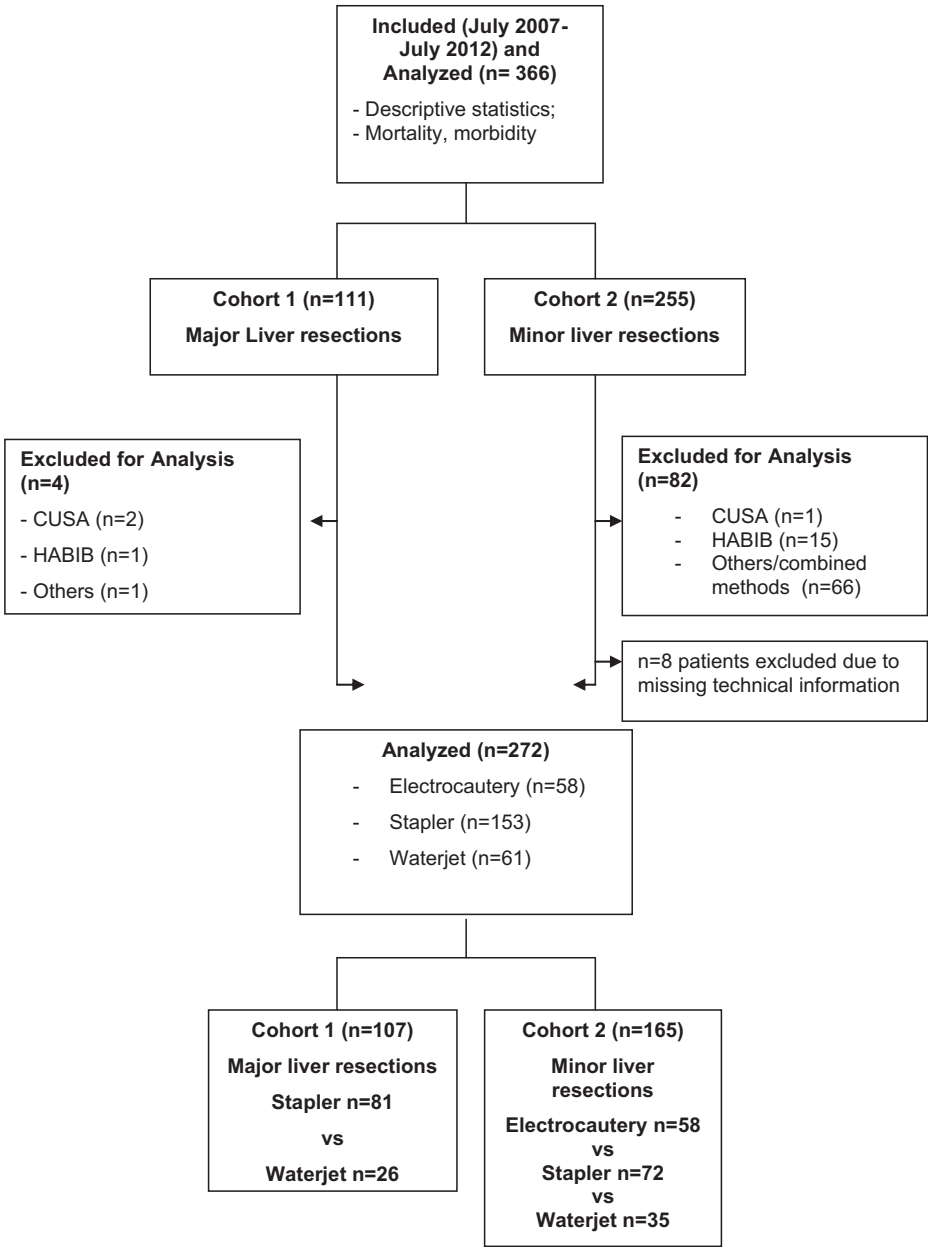

Fig. 1. Overview showing the formation of groups for further analyses out of 366 liver resections included in this analysis.

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