Eleven of the studies were included in the final review. Seven (3-9) were cohort studies, three (10-12) were economic evaluations and one (13) was a RCT. The remaining study (14) was a conference abstract. Eleven of the studies were completed retrospectively, with only Fretland et al (13) being completed prospectively.

The complication incidence across all studies was between 7.6% and 73.2%.

The wide disparity is attributable to variability in definitions of complications across studies.

Increasing costs with the occurrence of complications was a common finding across all studies (Figure 1).

All four studies which graded complications demonstrated that costs increased along with severity of complications (Figure 2).

Three studies reporting mortality showed greatly increased costs associated with mortality.

Postoperative liver failure was the most expensive complication, costing $89,450 more than uncomplicated patients. 87.5% patients with postoperative liver failure died, highlighting the extreme clinical cost of postoperative liver failure.

There was disagreement amongst the three studies reporting financial information for surgical technique (Figure 4). Cannon et al (10) found laparoscopic and open techniques were equipvalual with the exception of major deviations from postoperative course, where the open technique cost more. Vanounou et al (12) found that laparoscopic cost less than open surgery. Freitland et al (13) found the overall costs of laparoscopic and open resection to be equipvalual.

Increased length of stay following the occurrence of complications was a consensus finding amongst the six studies reporting the outcome. Knechtle et al (11) demonstrated that length of stay increased as the number of complications increased.

Vanounou et al (11) reported a mean incremental cost of $8929 ($95 CI $3321-$14536, p<0.001) for patients exceeding a length of stay beyond 8 days.

Knechtle et al (7) reported the rate of readmission increased from 5% for patients with no complications, to 14.3% for patients with 4 or more complications.

Two studies compared the cost of major and minor resection, and showed an increased cost associated with major liver resection.

Vanounou et al (11) reported a mean incremental cost of $15,295 ($95 CI: $9,272 to $25,110, p<0.001) for hemi-hepatectomy compared to a partial resection.

Risk of bias

Fretland et al (13) was considered to have 'low risk' of bias.

Excluding the conference abstract (14), six (3-8) of the retrospective cohort studies were considered to have an 'acceptable' risk of bias, whilst one (9) was 'high'. The be of 'low quality'. The three (10-12) economic evaluations were deemed to be of 'high quality'.

However, as the primary outcome data required for this review were not primary outcomes for the economic evaluations, these studies were also assessed against the SIGN Cohort Study Checklist and found to be of 'acceptable' quality.

Postoperative complications following hepatectomy have a major impact on the clinical and economic burden facing health care providers, at both the systemic and individual level. This burden is worsened as the severity of complications increases. We found robust evidence supporting the increasing economic burden arising from complications after liver resection. Despite considerable heterogeneity in study designs, patient populations, and outcome definitions, we found weak evidence of increased costs associated with major liver resection compared to minor resections. Robust evidence supporting that costs increase with the development and severity of complications was found. The development of postoperative liver failure was associated with the highest costs. Our review found strong evidence concerning the association of length of stay with costs.

In order to allow effective implementation of strategies to reduce this burden, future studies assessing the economic impact of complications require improvements in quality, reliability, and consistency of methodology.

References