A systematic review and meta-analysis of portal vein ligation versus portal vein embolization for elective liver resection

Sanjay Pandanaboyana, FRCS, MPhil,[a] Richard Bell, MBCHB, MRCS,[a] Ernest Hidalgo, PhD, FRCS,[a] Giles Toogood, MD, FRCS,[a] K. Raj Prasad, MS, FRCS,[a] Adam Bartlett, PhD, FRACS,[b] *and* **J. Peter Lodge, MD, FRCS,[a]** *Leeds, West Yorkshire, United Kingdom, and Auckland, New Zealand*

Introduction. *This meta-analysis aimed to review the percentage increase in future liver remnant (FLR) and perioperative outcomes after portal vein ligation (PVL) and portal vein embolization (PVE) before liver resection.*

Methods. *An electronic search was performed of the MEDLINE, EMBASE, and PubMed databases using both subject headings (MeSH) and truncated word searches to identify all articles published that related to this topic. Pooled risk ratios were calculated for categorical outcomes and mean differences for secondary continuous outcomes using the fixed-effects and random-effects models for meta-analysis.*

Results. *Seven studies involving 218 patients met the inclusion criteria. There was no difference in the increase in FLR between the 2 groups 39% (PVE) versus 27% (PVL; mean difference [MD] 6.04; 95% CI, −0.23, 12.32; Z = 1.89; P = .06). Similarly, there was no difference in the morbidity (risk ratio [RR], 1.08; 95% CI, 0.55, 2.09; Z = 0.21; P = .83) and mortality (RR, 0.87; 95% CI, 0.19, 3.92; Z = 0.18; P = .85) in the 2 groups after liver resection. While awaiting liver resection after PVL and PVE, no difference was noted in the number of patients developing disease progression (RR, 0.93; 95% CI, 0.52, 1.66; Z = 0.24; P = .81). In a subset analysis comparing FLR with PVE and PVL as part of the procedure called an associating liver partition with PVL for staged hepatectomy (ALPPS), there was a significant increase in FLR in favor of ALPPS (MD, −17.09; 95% CI, −32.78, −1.40; Z = 2.14; P = .03).*

Conclusion. *PVL and PVE result in comparable percentage increase in FLR with similar morbidity and mortality rates. The ALPPS procedure results in an improved percentage increase in FLR compared with PVE alone. (Surgery 2015;157:690-8.)*

From the St James Hospital,[a] Leeds, West Yorkshire, United Kingdom; and the Department of Surgery,[b] Auckland City Hospital, Auckland, New Zealand

Over the past decade, advances in surgery, anesthesia, radiology, and oncology have resulted in an extension of the criteria for resectability of liver neoplasms,[1-3] but a small volume of the future liver remnant (FLR) has been the Achilles heel limiting major hepatectomy.[4,5] Several strategies have evolved over the last few years to achieve an adequate FLR. Portal vein embolization (PVE) is an effective strategy for inducing hypertrophy of the FLR and, therefore, increasing the safety of extended hepatectomy; however, a small fraction of patients do not achieve an adequate FLR after PVE.[6,7] In addition, there is some evidence to suggest that PVE leads to interval tumor progression.[8-11] Alternative methods to increase the FLR include portal vein ligation (PVL),[12] 2-stage hepatectomy,[13] and the associating liver partition with PVL for staged hepatectomy (ALPPS) procedure. Some studies have shown PVL to be less efficient than PVE[14] owing to intrahepatic portoportal collaterals, whereas others have shown a comparable increase in FLR.[15] In addition, PVL involves operative ligation of the portal vein, thereby incurring the risks of the operative procedure. The recently introduced ALPPS procedure has been used as an additional strategy to induce a rapid increase in FLR volume, but ALPPS seems to be associated with increased surgical morbidity.[16]

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Reprint requests: Sanjay Pandanaboyana, FRCS, MPhil, Consultant HPB and Transplant Surgeon, Surgical Offices, Level 7, Support Building, Auckland City Hospital, Grafton, Auckland, New Zealand, 1010. E-mail: sanjay.pandanaboyana@gmail.com.

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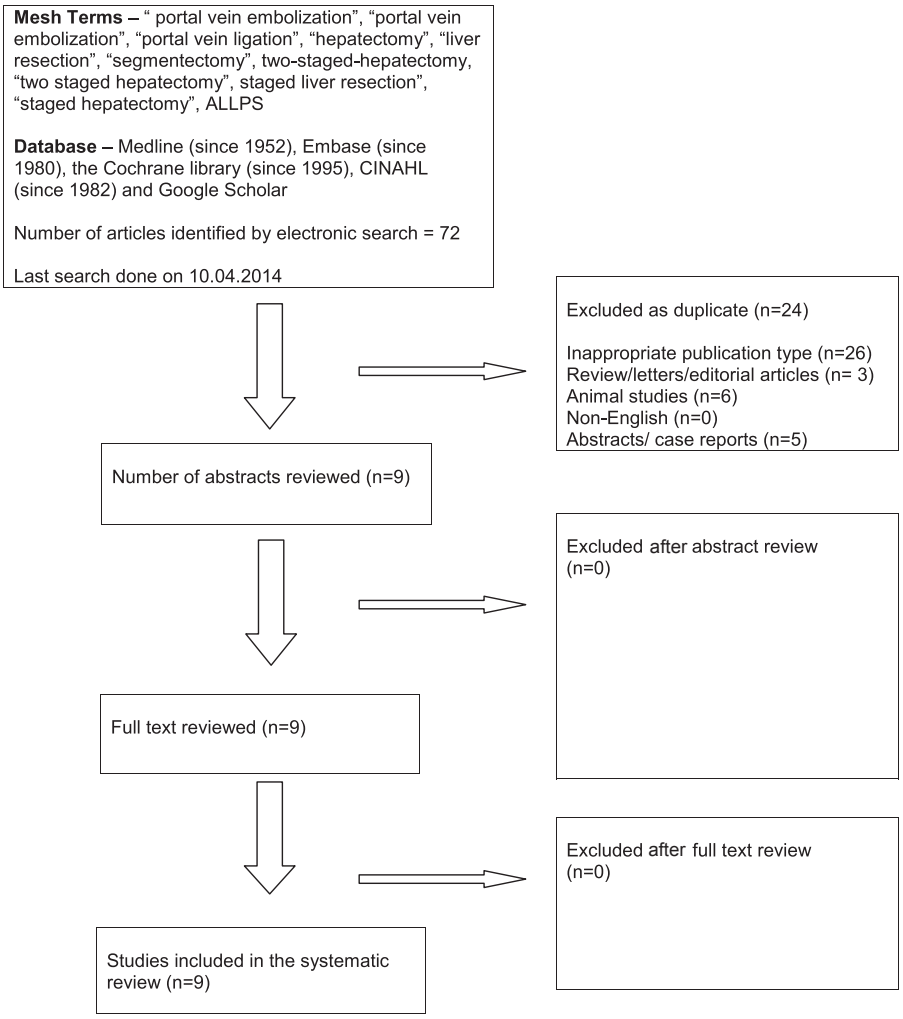

Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram. *ALPPS*, Associating liver partition with portal vein ligation for staged hepatectomy.

The purpose of this systematic review and meta-analysis was to compare PVL and PVE to assess the percentage increases in FLR, morbidity, mortality, and tumor progression with the 2 techniques. In addition, a subgroup analysis was performed to assess the percentage increase in FLR after PVE or ALPPS procedure.

METHODS

Randomized and case-controlled studies, irrespective of language, country of origin, hospital, blinding, sample size, or publication status, that compared the use of PVL and PVE for elective liver resection were included in this review. The Cochrane Colorectal Cancer Group Controlled Trials Register, the Cochrane Central Register of Controlled Trials in the Cochrane Library, MEDLINE, Embase, and Science Citation Index Expanded were searched for articles published up to January 2014 using the medical subject headings (MeSH) terms portal vein ligation, PVE, staged hepatectomy, staged liver resection, liver resection, and ALPPS procedure. Equivalent free-text search terms, such as "portal vein ligation" and "portal vein embolization" were used in combination with "liver resection" and "hepatectomy." The references from the included studies were searched to identify additional studies comparing the 2 techniques (Fig 1).

All patients who underwent liver resection for both benign and malignant conditions in both normal and diseased (cirrhotic) livers were included. Inclusion criteria for searching were studies evaluating the use of use of PVE and PVL for elective liver resection.

Types of outcome measures. The primary outcome measure was percentage increase in FLR after PVE and PVL. Secondary outcome