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Association Between Donor Age and Survival Outcomes of Liver Transplantation in Patients with Hepatocellular Carcinoma: A Systematic Review and Meta-analysis

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ADMINISTRATIVE INFORMATION**Support** - None.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202610104**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 31 January 2026 and was last updated on 31 January 2026.**INTRODUCTION**

Review question / Objective The use of marginal liver grafts in liver transplantation (LT) has risen in response to the growing organ disparity. With the global population aging, donors of advanced age have become an increasingly utilized source to address the shortage of available livers. Hepatocellular carcinoma (HCC) is now a leading indication for liver transplantation. However, the influence of donor age on HCC recurrence after transplantation remains uncertain. This study aimed to evaluate HCC recurrence in patients who received liver grafts from older donors.

Condition being studied LT remains the standard of care for patients with end stage liver disease including those with HCC. The critical shortage of

donor organs has driven greater use of marginal grafts from older donors. In the United States, the proportion of liver transplants using grafts from older donors rose from 5.5% in 1995 to 14.6% in 2014. In Europe, the use of donors aged over 60 has expanded considerably, with data from the European Liver Transplant Registry showing an increase from 1% in 1989 to 29% in 2009. However current evidence regarding the influence of donor age on transplant outcomes in HCC patients including tumor recurrence and survival remains limited. Therefore a systematic review and meta analysis to evaluate the effect of donor age on these outcomes is warranted.

METHODS

Search strategy The literature was searched in PubMed Embase Cochrane Library and Web of

Science databases from the inception of each database to December 1 2025. The following key terms were used: “donor age,” “hepatocellular carcinoma,” “liver transplantation.” Reference lists of relevant systematic reviews and conference proceedings were manually screened to identify additional eligible studies.

Participant or population Patients with HCC.

Intervention Patients with HCC undergoing LT.

Comparator Compare the prognostic effects of elderly donor liver and non elderly donor liver on HCC liver transplantation.

Study designs to be included We included studies that examined the association between donor age and outcomes in patients with HCC undergoing LT.

Eligibility criteria Eligible studies included in this meta-analysis met the following criteria: (i) patients underwent LT for HCC; (ii) donor age was reported as a key exposure variable; (iii) the LT and (iv) recurrence was diagnosed based on radiological or histopathological evidence according to standard clinical criteria.

Information sources The literature was searched in PubMed, Embase, Cochrane Library and Web of Science databases from the inception of each database to December 1 2025.

Main outcome(s) This meta-analysis confirms that advanced donor age is associated with a higher risk of tumor recurrence after transplantation. Although overall survival may not be significantly compromised, the elevated recurrence risk highlights the importance of intensified post-transplant surveillance in recipients of older grafts.

Quality assessment / Risk of bias analysis The Newcastle Ottawa Scale was used to evaluate the quality of included studies. This scale comprises three key parameters including selection comparability and outcome assessment. The highest score achievable with this scale is 9 points. Studies that obtained a score of more than 6 points were considered as high quality studies.

Strategy of data synthesis Pooled estimates of HR and 95% CI for OS and tumor recurrence were obtained from each article.

Subgroup analysis Subgroup analysis was conducted based on whether the liver donor was over 40 years old or over 60 years old.

Sensitivity analysis The publication bias in this meta-analysis was assessed using funnel plot.

Country(ies) involved China.

Keywords Hepatocellular carcinoma; liver transplantation; donor age; meta-analysis.

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