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The Role Of Three-Dimensional Imaging Reconstruction In Complex Mininvasive Liver Resections

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Background : Parenchyma-saving liver surgery, calculation of the future liver remnant (FLR) and surgical technique improve minimally invasive liver surgery (MILS). 3D rendering (3DR) allows surgical planning, ameliorating intraoperative lesions identification and their relationship with vasculo-biliary structures

Methods : Between November 2019 and July 2021, 246 liver resections were carried out. Patients eligible for a preoperative 3DR (lesion multifocality or large dimensions; proximity, encasement, or invasion of critical vasculo-biliary structures; patients with increased surgical risk; planning of parenchyma-sparing resections; and substantial vasculo-biliary variations) underwent a 0.5 or 1 mm-thick tri-phasic abdominal CT scan at our Centre. Preoperative 3DR was performed in 82 (33.3%) cases, which were compared to 106 non-3DR patients through a propensity score matching (PSM) analysis for age, gender, ASA score, BMI, indication, neoadjuvant chemotherapy, previous abdominal surgery, previous hepatectomies, type of surgery, postero-superior segments, number and total size of the lesions ($\geq$5cm)

Results : Amongst all 82 3DR, 28 patients (37.0%) underwent preoperative changes of the original surgical plan: 14 concerned surgical access, anatomic variations, middle hepatic vein management, and preservation/resection of liver portions; 9 patients were excluded from surgical treatment (due to disease extension, FLR insufficiency, and/or patients with high surgical risk), and 5 received a new surgical indication. 3DR patients underwent a laparoscopic (54.8%), open (34.2%), or robotic approach (11%). Nodules $\geq$5cm were more common in 3DR group (69.4% vs 38.7%, p=0.003) but no differences in the number of repeat hepatectomy (p=0.109), type of resection (p=0.162), number of PS resections (p=0.118), and number of nodules (p=0.131) was found. After PSM analysis, we identified 32 cases in each group. The conversion rate (12.5% vs 18.7%, p=0.731) and blood loss (450 cc vs 425 cc, p=0.568) were similar. Blood transfusion (31.3% vs 43.8%, p=0.439), R1 vascular (12.5% vs 31.3%, p=0.129), incidence of Clavien-Dindo complications $\geq$3 (3.1% vs 12.5%, p=0.355), and length of stay (4.5 vs 5 days, p=0.545) resulted slightly improved in the 3DR group, although statistically not significant. Operative time (450 min vs 425 min, p=0.013) was significantly increased in 3DR group

Conclusions : 3DR in MILS has the potential to improve perioperative parameters, refine surgical strategy and allow a safe intraoperative change in surgical strategy leading to a more conservative approach while removing more liver lesions

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