Survey on the use of liver volumetry before major hepatic resection

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Introduction: Future Liver Remnant

The risk of post-hepatectomy liver failure (PHLF) after liver resection is determined by the size of the future liver remnant (FLR). The smaller the FLR, the higher the risk of developing PHLF. Preoperative imaging is used to calculate the FLR by comparing the FLR to the total liver volume. Alternatively, the calculated liver volume can be used to determine the sFLR. This method has gained acceptance in recent years.

Published thresholds have been established for the FLR at which patients should undergo surgery. A minimum FLR of 20-25% is considered sufficient for a healthy, undamaged liver. For patients with neoadjuvant chemotherapy or mild liver damage, a FLR of 30% is suggested, while for those with liver fibrosis or cirrhosis, at least a 40-50% FLR is considered safe. This 20/30/40 rule is frequently referred to in the current literature. If the FLR is not large enough before surgery, there are various methods to increase its size. Once the FLR has been enlarged, liver resection can be performed with reduced risk of PHLF and mortality.

This survey aims to evaluate the use of liver volumetry and analyse the different pre-resection strategies used by HPB centres and surgeons.

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Guglielmi A, et al. How much remnant is enough in liver resection? Dig Surg. 2012

Shoup M, et al. Volumetric analysis predicts hepatic dysfunction in patients undergoing major liver resection. J Gastrointest Surg. 2003

Vauthey JN, et al. Standardized measurement of the future liver remnant prior to extended liver resection: methodology and clinical associations. Surgery. 2000

Kishi Y, et al. Issues to be considered to address the future liver remnant prior to major hepatectomy. Surg Today. 2021

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Survey

Institution specific

1. Country
    a. Text:
2. Name of Medical Institution **not mandatory*
    a. Free text
3. Type of Medical Institution:
    a. Academic Hospital
    b. Other Public Hospital
    c. Private Hospital
    d. Other (please specify)
4. How many liver resections are performed at your institution per year?
    a. ≤50
    b. 51-100
    c. 101-150
    d. >150
5. How many major resections are performed in your institution each year? (Defined as a resection of ≥ 3 liver segments)
    a. ≤10
    b. 11-20
    c. 21-40
    d. >40

Surgeon specific

6. How many years have you practiced as a surgeon?
    a. ≤5
    b. 5-10
    c. 10-15
    d. >15
7. If you are a sub-specialist HPB surgeon: How many years have you practiced as such?
    a. ≤5
    b. 5-10
    c. 10-15
    d. >15
8. How many liver resections do you perform per year?

a. ≤15
b. 15-30
c. 30-50
d. >50

9. How many major liver resections do you perform per year?
    a. ≤5
    b. 5-10
    c. 10-15
    d. >15

Future liver remnant specific questions

10. Does your institution perform liver volumetry before liver resection?
    a. Yes
    b. No
11. If no, what are the reasons for not performing liver volumetry? (select all that apply) **not mandatory*
    a. Lack of expertise
    b. Lack of equipment
    c. Not deemed necessary
    d. Low patient volume
    e. Other (please specify)
12. Do you as a surgeon use FLR-volumetry before liver resection?
    a. Yes
    b. No
13. Do you perform liver function testing (besides lab-values) before major hepatectomy?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
14. Which liver function assessment method(s) (besides lab-values) do you use? (select all that apply)
    a. None
    b. ICG test
    c. LiMAx
    d. Scintigraphy
    e. MRI function analysis
    f. Other (please specify)

15. Which factors do you consider in your assessment of a patient's eligibility for major hepatectomy? (select all that apply)
    a. FLR
    b. Liver function assessment (besides lab-values)
    c. Performance status (ECOG or similar)
    d. Age
    e. Tumour type
    f. Other (please specify)

Continue if FLR is used

16. What percentage of major liver resections at your center undergo liver volumetry?
    a. ≤10%
    b. 10-20%
    c. 21-30%
    d. 31-40%
    e. >40%
17. What is the most common indications for performing liver volumetry at your institution? (select all that apply)
    a. Hepatocellular carcinoma
    b. Intrahepatic Cholangiocarcinoma
    c. Perihilar Cholangiocarcinoma
    d. Gallbladdercancer
    e. Colorectal Liver Metastasis
    f. Other liver metastases
    g. Other (please specify)
18. Do you have a standardized policy or algorithm in your clinic for which patients FLR volumetry is used?
    a. Yes
    b. No
19. Do you use:
    a. FLR calculated as percentage from a standardized total estimated liver volume (TELV)?
    b. FLR as percentage from a measured total liver volume?
    c. Other (please specify)
20. Which resections would you perform FLR-volumetry for? (select all that apply)
    a. All resections
    b. Major resections

c. Minor resections
d. Multiple minor resection
e. Complex parenchyma sparing

21. Do you perform volumetry for anatomic right hepatectomy (segments 5-8, ± segment 1)?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
22. Do you perform volumetry for anatomic extended right hepatectomy (segments 4-8, ± segment 1)?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
23. Do you perform a volumetry for anatomic left hepatectomy (segments 2-4, ± segment 1)?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
24. Do you perform a volumetry for anatomic extended left hepatectomy (segments 2-5+8, ± segment 1)1?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
25. Who performs the volumetry? (select all that apply)
    a. Senior Surgeon
    b. Junior Surgeon
    c. Senior Radiologist
    d. Junior Radiologist
    e. Other (please specify)
26. What software or tools do you use for liver volumetry? (select all that apply)
    a. Commercial software (please specify)
    b. In-house software
    c. Manual calculation

d. Do not know / Unknown

27. Do you stick to the 20/30/40% rule?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
28. Do you think the 20/30/40% values are accurate?
    a. Yes
    b. No
29. Would you adapt (increase) the requiered FLR for patients? (select all that apply)
    a. No
    b. Considering age
    c. Considering comorbidities
    d. Considering tumour type
    e. Other (please specify)
30. What is your cut-off value to perform a hypertrophy/modulation procedure for the FLR in patients with a healthy liver?
    a. ≤20%
    b. 20-25%
    c. 25-30%
    d. 35-40%
    e. >40%
31. What is your cut-off value to perform a hypertrophy/modulation procedure for the FLR in patients with liver disease (non-cirrhotic) or previous chemotherapy?
    a. ≤20%
    b. 20-25%
    c. 25-30%
    d. 35-40%
    e. >40%
32. What is your cut-off value to perform a hypertrophy/modulation procedure for the FLR in patients with cirrhosis?
    a. ≤20%
    b. 20-25%
    c. 25-30%
    d. 35-40%
    e. >40%
33. For which tumour types would you adapt (increase) the calculated FLR?

a. None
b. Hepatocellualr carcinoma
c. Colorectal cancer liver metastases
d. Intrahepatic cholangiocarcinoma
e. Perihilar cholangiocarcinoma
f. Gallbladder cancer
g. Other (please specify)

34. Would you consider the kinetic growth rate of the FLR as an important parameter?
    a. Yes
    b. No
35. Do you use the kinetic growth rate of the FLR to adapt (increase or decrease) the required FLR?
    a. Yes
    b. No
36. Would you refuse surgery for a patient with a sufficient FLR but insufficient liver function test?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
37. Would you refuse surgery for a patient with an insufficient FLR but sufficient liver function test?
    a. Routinely
    b. Frequently
    c. Rarely
    d. Never
38. Additional comments