# The feasibility and effectvity of laparoscopic liver surgery versus open surgery

M. Brand Department of Surgery University of Pretoria For new surgical procedures to become widely adopted as standard operations, they should first be compared with established procedures and shown to be superior in at least some respects.

Wakabayashi et al.. 2014

# Laparoscopic liver surgery

- Is it better than open liver resection?
- Is it safe?
- Improved peri-operative care?
- Oncologically sound?
- Does it make socio-economic sense?





Wakabayashi et al.. 2014

	Open right hepatectomy	Laparoscopic right hepatectomy	(visibility/
			restriction)
Incision	20-40 cm, upper abdomen	10 cm, suprapubic region	NE/NE
Mobilization	Poor view around IVC	Better exposure but some restriction	++/
Inflow occlusion	Risk of P1 injury	Better exposure with gentle maneuver	++/
Parenchyma transection	Meticulous exposure of intra-parenchymal structures	Magnified exposure of intra-parenchymal structures	++/NE
Hepatic vein bleeding	Low CVP required	Reduction with pneumoperitoneal pressure	++/
Massive bleeding	Rapid closure possible	Difficult to close	NE/
Root of the hepatic vein and Glissonian pedicle closure	Stapler or suturing	Stapler mandatory	+/

#### Table 2 Theoretical comparison of open and laparoscopic right hepatectomy

CVP central venous pressure, IVC inferior vena cava, NE no effect, P1 portal vein to the caudate lobe

Royal College of Surgeons guideline for liver resection: ...the aim is to resect the liver with minimal bleeding and leaving adequate functional liver. Nguyen KT et al.. Comparative Benefits of Laparoscopic vs Open Hepatic Resection Arch Surg. 2011;146(3):348-356

Analyzed 31 publications

- 15 studies showed decreased blood loss with laparoscopic liver resection.
- 27 studies showed no difference with blood transfusion requirement, 4 showed significantly less with laparoscopic surgery
- The largest series showed a transfusion rate 0.7% versus 8% in open surgery

### **Oncological outcomes**

# Margins

- No port-site recurrence or tumor seeding has been reported
- 14 studies reported margins: 13 no difference, 1 wider margins with laparoscopic resections
- 12 studies reported 3 and 5y overall survival: **no difference**

Nguyen et al. 2011

# Socio-economic costs

- Length of procedure
- Equipment
- Post-operative morbidities
- Length of stay
- Return to work



#### Fig. 1

Total cost LPD and OPD. The total cost, shown at the *superior* aspect of the *bar graph*. The total cost is made up of the surgical cost, *lower* aspect of the *bar graph*, and the admission cost, *upper* aspect of the *bar graph*. p = 0.95

> Mesleh 2013

Table 4 Total hospital costs for           laparoscopic versus open	Authors	Curren	cy Open	Laparoscopic	Difference	% diff	p value
hepatectomy	Polignano et al. [10]	GBP	14,298	11,727	-2571	-18 %	0.04
	Tsinberg et al. [20]	USD	47,358	36,784	-10,574	-22.3	0.04
	Vanounou et al. [11]	USD	18,043	15,104	-2939	-16.3 %	
	Bhojani et al. [18]	CAD	12,523	11,376	-1147	-9.2	0.07
	Stoot et al. [14]	EUR	6580	5969	-611	-9.3	0.06
	Canon et al. [12]	USD	69,728	58,401	-11,327	-16.2 %	
	Abu Hilal et al. [17], LLS	GBP	10,121	8356	765	-17.4	0.0001
	Abu Hilal et al. [17], RH	GBP	14,050	14,054	+4	0	NS
	Dokmak et al. [16]	EUR	11,504	7475	-4029	-35 %	0.001
	Medbery et al. [13]	USD	26,751	25,679	-1072	-4 %	NS
	Kawaguchi et al. [19]	USD	11,858	12,046	+188	+2 %	NS
	Bell et al. [15]	GBP	5593	3594	1999	-35 %	0.001

Cleary 2016

#### Left lateral sectionectomy:

laparoscopic approach has become standard of

#### care

Chang S et al.. *Laparoscopy as a routine approach for left lateral sectionectomy*. BJS 2006

- Reported 36 consecutive cases
- No death, mean blood loss 200ml, no transfusion, median LOS 5.2 days

Hasegawa Y et al.. Laparoscopic left lateral sectionectomy as a training procedure for surgeons learning laparoscopic hepatectomy. JHBPS 2013.

• *Reported 24 consecutive LLLS's* 

# Laparoscopic vs open left lateral segmentectomies at the University of Pittsburgh

- laparoscopic left lateral segmentectomy had a shorter length of stay (3 vs 5 days; P < .001)</li>
- weighted average median cost savings of \$1527 to \$2939 compared with open left lateral segmentectomy

# Liver resection (LLR)

- Louisville consensus guideline updated in 2015 Morioka
- Safe: A review of 2804 LLR's (127 publications)(Nguyen et al. 2009)
  - All cause mortality 0.3%
  - 10.5% morbidity
- Oncological margins (positive margins and failure to identify occult metastases)
  - mCRC study 109 patients 95% negative margins with 50% 5 year overall survival
  - mCRC study 107 47% 5 year survival

# Laparoscopic left hemi-hepatectomy as standard of care?

- International database 1620 laparoscopic liver resections, L lateral vs LH
- 222 LL vs 82 LH

### Belli et al. Surg Endosc 2013

	L lat $(n = 222)$	LH $(n = 82)$	p value
OR time (h)	$2.9 \pm 1.4$	$3.9 \pm 2.3$	< 0.001
EBL(cc)	$198 \pm 198$	$306 \pm 371$	0.003
Transfusion	65 (29 %)	39 (47 %)	0.004
Conversion	3 (1 %)	3 (4 %)	0.199

Table 2 Intraoperative outcomes

OR operative time; EBL estimated blood loss

Table 3	Postoperative	outcomes
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	L lat $(n = 222)$	LH ( $n = 82$ )	p value
LOS (days)	$2.5 \pm 2.3$	$7.1 \pm 5.1$	< 0.001
R2 resections	3 (1 %)	1 (1 %)	0.935
Margin (cm)	$1.84 \pm 1.2$	$1.51 \pm 1$	0.314
Morbidity	40 (18 %)	16 (20 %)	0.765
Tumor recurrence	34 (15 %)	9 (10 %)	0.333
90-day mortality	3 (1 %)	1 (1 %)	0.923

LOS length of hospital stay

# Possible indications for CRCLM LLR

- Solitary mCRC tumor in the liver
- <5 cm in size
- Involving the left lateral section or right anterior hepatic segments 5 or 6
- A second small peripheral metastasis in an accessible location or near the index lesion

Anatomic left or right hepatic lobectomy can be considered, but this operation generally requires 2 surgeons with advanced laparoscopic skills and experience with liver resection Table II. Comparison of demographics, operative characteristics and postoperative outcomes between LLR and OLR patients

				Р
	Variable	LLR	OLR	value
	Sex (% male)	54.6	59.6	.84
	Average age (v)	60.8	69 1	50
	Tumor size (cm)	3.1	3.43	.35
	No. of metastases	1.37	1.48	.14
	Major hepatectomy (%)	34.7	38.6	.95
Tumor and surgical	Right hepatectomy, $n$ (%)	57 (23.5)	89 (24.2)	.97
procedure	Left hepatectomy, n (%)	22 (9.1)	56 (15.2)	.29
procedure	Left lateral segmentectomy, n (%)	25 (10.3)	29 (7.9)	.58
	Segmental hepatic resection $n(\%)$	133 (55)	204 (55.4)	.98
	Operative time $(min)$	948 7	262.8	85
	Blood loss (mL)	262.5	385.1	.049
Blood loss	Transfusion rate (%)	9.9	19.8	.004
	overan complication rate (%)	20.3	<u> </u>	.03
Complications	Liver-specific complication rate (%)	12.8	8.8	.65
	30-day mortality (%)	0.5	0.9	.92
	Length of stay (d)	6.5	8.8	01
	R1 margin positivity (%)	5.5	12.6	.36
Oncologic margin	Margin width (cm)	0.81	0.83	.17
	neoadjuvant chemotherapy (%)	94.0	49.3	.92
	Adjuvant chemotherapy (%)	70.7	71	.63

Schiffman et al. 2015

LLR, Laparoscopic liver resection; OLR, open liver resection.

### Hepatocellular carcinoma

#### Table 3 Results of meta-analysis comparing laparoscopic vs open hepatectomy (only high-quality studies)

Outcome of interest	No. of studies	No. of patients	OR/WMD	95%CI	<i>P</i> value	Heterogeneity <i>P</i> value	<i>I</i> ² (%)
Operative outcomes							
Operation time (min)	6	354	4.69	-22.62, 32.00	0.74	0.0002	79
Intraoperative blood loss (mL)	6	333	-129.48	-224.76, -34.71	0.008	0.01	67
Blood transfusions requirement	7	416	0.49	0.26, 0.9	0.02	0.89	0
Postoperative outcomes							
Liver failure	2	116	0.15	0.02, 0.95	0.04	1.00	0
Cirrhotic decompensation/ascites	7	416	0.32	0.16, 0.61	0.001	0.95	0
Bile leakage	3	205	0.55	0.10, 3.12	0.50	0.86	0
Postoperative bleeding	5	287	0.54	0.20, 1.45	0.22	0.83	0
<ul> <li>Pulmonary complications</li> </ul>	6	384	0.43	0.18, 1.0	0.06	0.46	0
Intra-abdominal abscess	2	101	0.21	0.01, 4.53	0.32		-
Mortality	8	474	0.46	0.14, 1.51	0.20	0.64	0
<ul> <li>Hospital stay</li> </ul>	6	333	-3.19	-4.09, -2. 8	< 0.00001	0.91	0
Oncologic outcomes							
Surgery margin positive rate	5	287	0.59	0.21, 1.62	0.31	0.65	0
Tumor recurrence	7	416	0.95	0.62, 1.46	0.81	0.93	0

WMD: Weighted mean difference; OR: Odds ratio.

Xiong 2012

# Morioka statement

- Laparoscopic outcomes are not inferior for major and minor liver resections
- Laparoscopic complication rates are superior for minor resections and not inferior for major resections
- Laparoscopic blood transfusion requirement superior
- Length of hospital stay are superior for major and minor resections
- Laparoscopic specimen margin negativity not inferior for major and minor resections
- Laparoscopic costs for major resection were not inferior
- Pain and quality of life superior with laparoscopic surgery
- Incisional hernia rate was lower with laparoscopic surgery

### Is it feasible?

'possible to do easily or conveniently'

Theasaurus:

Practical; achievable; realizable; sensible; suitable; doable

Antonym: Impractical

### Is it effective?

Successful in producing a desired or intended result

Thesaurus: Helpful; beneficial; advantageous; useful

Antonyms: Ineffective; weak

#### In Pretoria

#### **Laparoscopic Liver Resection**

- 11 blade
- 2 Littlewood or Allis tissue forceps
- 2 5mm ports
- 3 12mm ports
- 30 degree lens
- 2 Blunt nosed dissectors
- 1 Maryland dissector
- 1 Diathermy hook

#### **Special equipment**

- Ligasure
- Echelon stapler with reloads-white
- Hem-o Lok clips- small, medium and large
- Hem-o-lok clip applier
- Hem-o-Lok clip remover
- Endoclip-small
- 15cm Endopouch
- Surgicel

#### Sutures

- Prolene 4-0
- Vicryl 2-0
- Monocryl 4-0

#### On stand-by in theater packed separately

Laparoscopic needle holder Suction-irrigation set

Vessel loops 5mm surgical tape

Open sets for conversion Omnitract for conversion

#### Within the surgeon's training and comfort zone

#### **IRCAD 2014**