

Modified Makuuchi incision for major upper abdominal surgeries

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
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ABSTRACT:

Background: Numerous incisions are described for abdominal operations. However, opinion is divided regarding the correct choice of incision for major upper abdominal surgeries.

Materials and methods: Experience of 3 surgical centres with the use of modified Makuuchi incision, for major upper abdominal surgeries, from Mar 2014–Dec 2018, was audited.

Results: 144 patients (76 Males, 68 Females) with an average age of 48.25 years underwent surgery using modified Makuuchi incision. 'J' and 'L' incisions were used in 96 and 48 patients, respectively. Further extension of the incision was necessary in 2 patients. Adequate exposure and enhanced surgical ergonomics was observed in all cases. Surgical site infection was seen in 19 patients (13.2%). Incisional hernias was observed in 6 patients (4.2%), on an average follow up of 27.78 months.

Conclusions: Modified Makuuchi incision proves efficacious for major upper abdominal surgeries.

KEYWORDS:

J/L incision, modified Makuuchi incision, upper abdominal surgery

ABBREVIATION

HA – Hepatic artery
MPD – Main pancreatic duct
PV – Portal vein
SMV – Superior mesenteric vein
SSI – surgical site infection
SV – Splenic vein

INTRODUCTION

In this era of minimal access surgery, conventional open exposure still has a place, especially, in the performance of major abdominal surgeries. Correct choice of incision plays a pivotal role in the safe performance and success of these procedures. The key concerns/yardsticks which govern this choice are: optimal exposure of the anticipated pathology/organs, ergonomics of dissection at depth, ergonomics of retraction, ease of extension, body habitus, previous surgical scars, rapidity of entry, security of closure, abdominal wall integrity, pain, surgical site infection and cosmesis [1]. In this article we audit our experience with modified Makuuchi incision [2] and justify our preference for this incision for major upper abdominal procedures, based on the above mentioned yardsticks.

MATERIALS AND METHODS

Patients undergoing abdominal procedures using modified Makuuchi incision at 3 centres in the Indian sub-continent between Mar 2014–Dec 2018 were audited. Patients' profile, diagnosis, surgery, complications were audited from prospectively maintained databases. The statistical analysis was performed using Microsoft Excel.

Technique (2): Modified Makuuchi incision starts in the mid-line at the xiphoid process and extends upto the supra-umbilical region, then runs transversely/obliquely towards the right or left flank till the anterior/midaxillary line, to form J/L shape. Exposure is obtained by folding the musculocutaneous flap, cephalad, and is maintained in place by sutures/retractors (Fig. 1.–3.).

The transverse portion of incision is apposed in 2 layers, using delayed absorbable sutures. The posterior layer, consisting of the transverse muscles and the posterior rectus sheath, is apposed first, followed by the anterior layer comprising of oblique muscles and anterior rectus sheath. The vertical component is apposed by suturing linea alba using number 1 loop polydioxanone (Fig. 4A.–C.).

RESULTS

One hundred and forty four patients (76 Males, 68 Females) with an average age of 48.25 years (range: 8–78 years) underwent abdominal operation using modified Makuuchi incision. 'J' and 'L' incisions were used in 96 and 48 patients, respectively. The details of procedures performed are tabulated in Tab. I. Eighteen patients had previous incisions in upper abdomen, all of which were mid-line, except 3 who had previous Kocher's incision.

Extension of the incision into a Rio-Branco incision was necessary in a patient who had locally advanced carcinoma caecum, along with a large textiloma densely adherent to the duodenum, pancreatic head, liver and anterior abdominal wall, due to a mop left behind during open cholecystectomy done 2 years back.

Extension into an inverted 'T' incision was necessary in a patient with a large hepatocellular carcinoma of left liver lobe, densely adherent to left hemi-diaphragm and stomach.

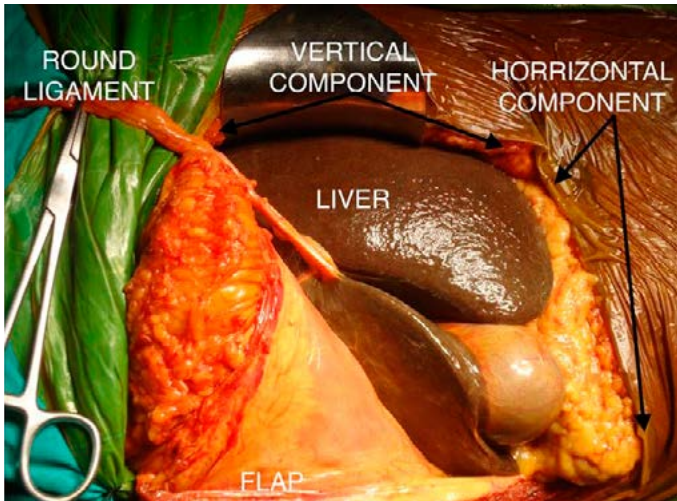


Fig. 1. 'J' incision showing the exposure of right upper quadrant. Flap held in place using sutures.

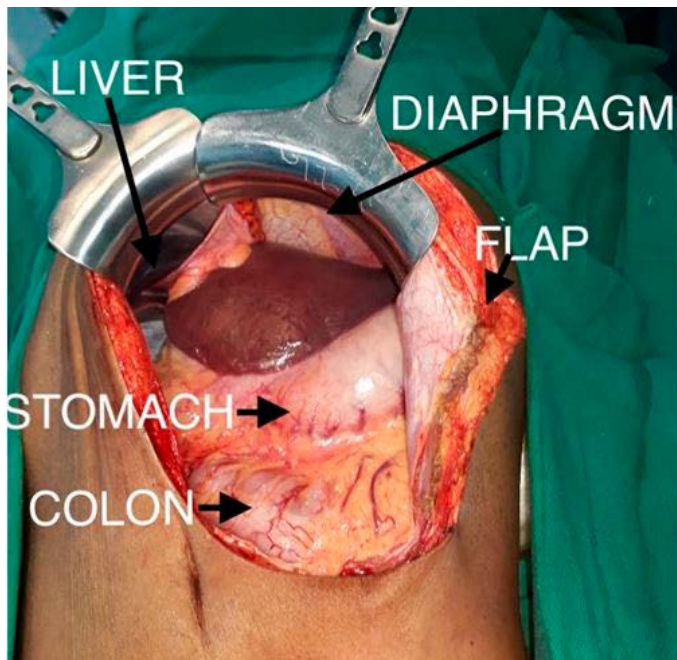


Fig. 2. 'L' incision showing the exposure of left upper quadrant and the diaphragm. Flap retracted using table mounted retractors.

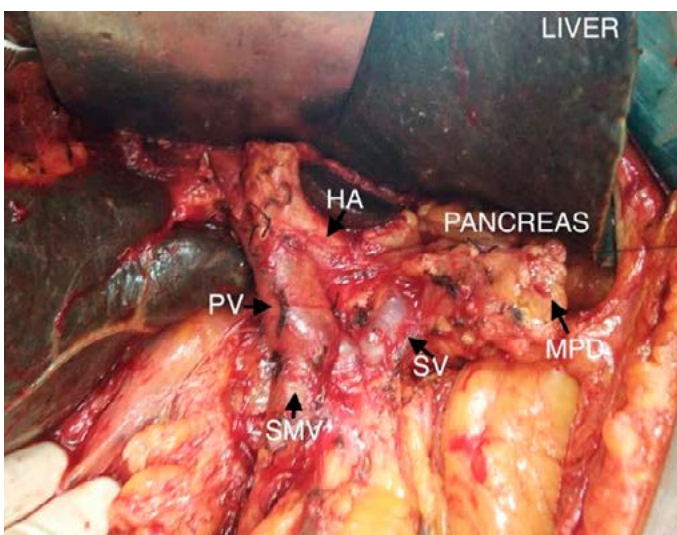


Fig. 3. Exposure of vital structures in the retroperitoneum.

Pain was well controlled by epidural analgesia for the first 3 post-operative days, following which injectable/oral non-steroidal anti-inflammatory drugs were found sufficient to alleviate the pain. Superficial and deep surgical site infection (SSI) were observed in 8 patients each (total – 11.1%). Organ space infection was seen in 3 patients [2.1%]. Incisional hernias (Fig. 4D.) were observed in 6 patients [4.2%].

There were 9 peri-operative mortalities [6.25%] due to various causes: myocardial infarction – 2, cerebrovascular accident – 1, cholangitis – 2, pulmonary embolism – 2, partial liver necrosis with abscess – 1, and ventilator dependence and associated pneumonia – 1. However, none of them were attributable to the incision per se or its complications. Average follow up was for 27.78 months (range 2–48 months), excluding the above mortalities.

DISCUSSION

Optimal exposure: Although, numerous abdominal incisions are described, they fall broadly into vertical, transverse, oblique, and thoraco-abdominal incisions [3, 4]. Vertical and transverse incisions provide longitudinal and horizontal exposure, respectively. Exposure of the other two dimensions is achieved by either retraction and/or lengthening of the incision. Both manoeuvres are damaging to the integrity of the abdominal wall. Surgery of upper abdominal organs, such as, liver, bile ducts, pancreas and spleen require exposure that is long, wide and deep. Modified Makuuchi incision opens up all the three dimensions optimally, thereby, providing access necessary for safe dissection (Fig. 1.–3.).

Major procedures, such as, right hepatectomy, pancreato-duodenectomy, gastrectomy and lino-renal shunt are, essentially, surgeries that are confined to a quadrant of the abdomen viz the right or left upper quadrant. Exposure of other quadrants is, both, unnecessary and desiccating/damaging to adjacent viscera. Long vertical/transverse/oblique incisions, tend to expose larger surface area of the peritoneum and gut to the desiccating effects of the atmosphere. Moreover, there is a need to pack off and retract the gut to prevent it from inconveniently getting into the operative field. Modified Makuuchi incision exposes only the quadrant needed for surgery (Fig. 1.–3.), the remainder of the quadrants are naturally covered by the abdominal wall, only the surface facing the incision site needs packing with moist sponge.

Thoraco-abdominal incision and inverted 'T' incisions, which are preferred for major hepatectomies, are notorious for pain, pulmonary complications and dehiscence at the trifurcation [5, 6]. We found the 'J' incision adequate for all types of major hepatectomies, including left hepatectomy. This is so because, the hepatic inflow and outflow pedicles, which are the main foci of dissection, are to the right of the midline, which are best exposed by 'J' incision (Fig. 1.). Moreover, the exposure of the cranial and diaphragmatic aspect of liver is well achieved using J incision. Extension into the chest or onto the opposite side of the abdomen was found, mostly, unnecessary. Similarly, left thoraco-abdominal incision, a preferred approach for lino-renal shunt and esophago-gastric junction surgeries, was also found unnecessary as 'L' shaped incision (Fig. 2.) provides optimal exposure for performance of these procedures [7].

Ergonomics: Most of the dissection, during major surgeries, is performed over the vessels, which are essentially in the retro-peri-

toneum (Fig. 3.), such as, during lymph node clearance, superior mesenteric artery first approach, inferior vena cava exposure etc. It is imperative that the plane of the operating instrument be parallel to the structure being dissected. When vertical/transverse/oblique incisions are employed the plane of instruments/hand is actually at vertical angles ($>45^\circ$) to the structure being dissected, despite retraction, which can be problematic. Modified Makuuchi incision provides superior operative ergonomics by allowing the hand and the instrument to be congruent to the structure being dissected, thereby, conferring additional safety.

The manual labour/force needed for retraction to gain exposure, in other incisions, is far greater, which may translate into tissue damage and post-operative pain. Whereas, the abdominal wall clearly lifts off like the flap of a tent and allows exposure (Fig. 1.), with minimal effort, when modified Makuuchi incision is employed. The self-retaining, table mounted retractors, such as, the Haribakhti retractor can also be easily deployed (Fig. 2.), without the bar coming in the way of operating surgeon or assistant [2].

Ease of extension: Several times, because of unanticipated pathology or adjacent organ involvement of infiltration, there is a need for greater exposure. This is achieved by accordingly extending the incision. Modified Makuuchi incision permits both the vertical and horizontal components to be extended in to Rio Branco or inverted 'T' incisions to provide the necessary exposure, as evident from our experience [2].

Body habitus: It is a general dictum to employ oblique incisions in patients with broad costal margin whilst a vertical incision in those with narrow ones. Modified Makuuchi incision works equally well in either body habitus, by providing adequate exposure.

Previous incisions: In case of previous midline or transverse incision, one can expose the same incisions and add the second component. In case where an oblique incision is placed previously, one runs the risk of devascularisation of the flap. However, this risk is not observed in those with previous incisions that are over 2 years old, as evident from our experience, as collaterals ensure adequate perfusion.

Ease of entry and rapidity of closure: Vertical incisions are easiest and fastest to make as there is no cutting of muscle or blood vessels [3, 4]. Addition of a transverse component takes a bit more time as there are muscles to cut and haemostasis to ensure. The same holds true for closure as well. The transverse component is apposed in 2 layers, whilst the vertical component in 1 layer [2].

Abdominal wall Integrity: Integrity of the parieties depends on the undamaged components of the abdominal wall, adequacy of vasculature and continuity of nerve supply [1]. Vertical incisions produce least damage to these components [3, 4]. However, since the direction of the incision is perpendicular to the direction of muscular pull, it has been speculated to have higher incisional hernia rate [3, 4, 8, 9]. Transverse incisions, on the other hand, are congruent to the direction of the muscular pull and, hence, are considered better [3, 4, 8, 9]. Modified Makuuchi incision has both these components. However, unlike the more commonly used rooftop/ inverted 'T' incision, there is no damage to vascular/neural supply to the abdominal musculature which translates into better abdominal wall integrity [3, 4]. Moreover, as the opposite side of the abdomen is left undisturbed, the vascularity, especially, at the



Fig. 4. A – Apposed 'J' incision; B – Healed 'J' incision; C – Healed 'L' incision; D – Incisional hernia in 'J' incision.

Tab. I. The details of procedures performed.

J INCISION 96	L INCISION 48
Whipple's Pancreatoduodenectomy –55	Linorenal shunt –25
Hepatotomy –13	Splenectomy for massive splenomegaly & hypersplenism –8
Left –3	
Right –3	
Extended Right –3	
Central –1	
Right posterior –2	
Right anterior –1	
Radical Cholecystectomy –11	Distal pancreatectomy –3
Jejunal gastrointestinal stromal tumour resection with liver metastasectomy –1	Excision of retroperitoneal teratoma –3
Drainage of multiple large liver abscesses –1	Total radical gastrectomy –5
Repair of hepatic artery psueodoaneurysm –1	Frey's procedure –2
Right hemicolectomy with textiloma resection –1	Esophageal perforation by foreign body –1
Choledochal cyst excision with hepaticojejunostomy –1	Repair of large gastric tear in morbidly obese –1
Large gastrointestinal stromal tumour resection –3	
Retroperitoneal necrosectomy with repair of hollow viscus perforation –1	
Hilar cholangiocarcinoma resection with caudate lobectomy –1	
Mesocaval shunt –2	
Hepaticojejunostomy for benign biliary strictures –5	

inferior angle of the incision is maintained, as evident from low hernia rate in our series [2, 5].

Pain: Among incisions, thoraco-abdominal incisions are most painful, due to proximity to the costal margin [3, 4, 6]. The incision lines in modified Makuuchi incision are well away from the costal margin, therefore, relatively less painful on respiration. The pain is well controlled by epidural analgesia and oral/injectable analgesics.

Cosmesis: All the upper abdominal incisions are obviously visible if exposed by dress. However, what appears grotesque are paradoxical movement of abdominal wall by phantom hernia or protruding, stretched scars of incisional hernia [10, 11]. Modified Makuuchi incision ensures good abdominal wall integrity resulting in low incisional hernia rate, as evident from our experience, thereby, translating into superior cosmesis (Fig. 4.).

REFERENCES

1. Meeks G.M., Trenhaile T.: Incision decisions: which ones for which procedure? *Obg Manag*, 2002; 14: 16–33.
2. Chang S.B., Palavecino M., Wray C.J. et al.: Modified Makuuchi incision for foregut procedures. *Arch Surg*, 2010; 145: 281–284.
3. Patnaik V.V.G., Singla R.K., Bansal V.K.: Surgical incisions: their anatomical basis: part IV- the abdomen. *J Anat Soc India*, 2001; 50: 170–178.
4. Burger J.W.A., van't Riet M., Jeekel J.: Abdominal incisions: techniques and postoperative complications. *Scand J Surg*, 2002; 91: 315–321.
5. Togo S., Nagano Y., Masumoto C. et al.: Outcome of and risk factors for incisional hernia after partial hepatectomy. *J Gastrointest Surg*, 2008; 12(6): 1115–1120.
6. Lumsden A.B., Colborn G.J., Sreeram S. et al.: The surgical anatomy and technique of thoracoabdominal incision. *Surg Clin North Am*, 1993; 73: 633–644.
7. Shah O.J., Robbani I.: A simplified technique of performing splenorenal shunt. *Tex Heart Inst J*, 2005; 32: 549–554.
8. Brown S.R., Goodfellow P.B.: Transverse versus midline incisions for abdominal surgery. *Cochrane Sys Rev*, 2005; 19: CD005199.
9. Williams Z., Hope W.: Abdominal wound closure: current perspectives. *Open Access Surg*, 2015; 8: 89–94.
10. Chawla S., Singh S.: Incisional hernia through non vertical incisions. *Med J Armed Forces India* 2000; 56: 316–319.
11. Chouillard E.Y., Aura T., Picone O. et al.: Incisional hernias. *Dig Surg*, 2003; 20: 3–9.
12. Razavi S.M., Ibrahimpoor M., Kashani A.S. et al.: Abdominal surgical site infections: incidence and risk factors at an Iranian teaching hospital. *BMC Surg*, 2005; 5: 2.
13. Sugiura T., Uesaka K., Kanemota H. et al.: Surgical site infection after pancreatoduodenectomy: single centre experience of 356 consecutive patients. *Gastroenterology*, 2011; 140(5): S1019.

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