

Is ICG (Indocyanine green) fluorescence guided laparoscopic cholecystectomy safer?

Jagpreet Singh Deed FRCS, FACS, MS, DNB (General Surgery)

Sajad Ali Mohammad MS, MRCS (UK), Diploma Laparoscopic surgery (France, IRCAD)

Department of General Surgery, Zulekha hospital,
Sharjah, United Arab Emirates



Background: recent enthusiasm with ICG guided laparoscopic cholecystectomy has led to its adoption by many. However, whether it make the operation safer by reducing possibility of CBD injury, is yet to be evaluated scientifically

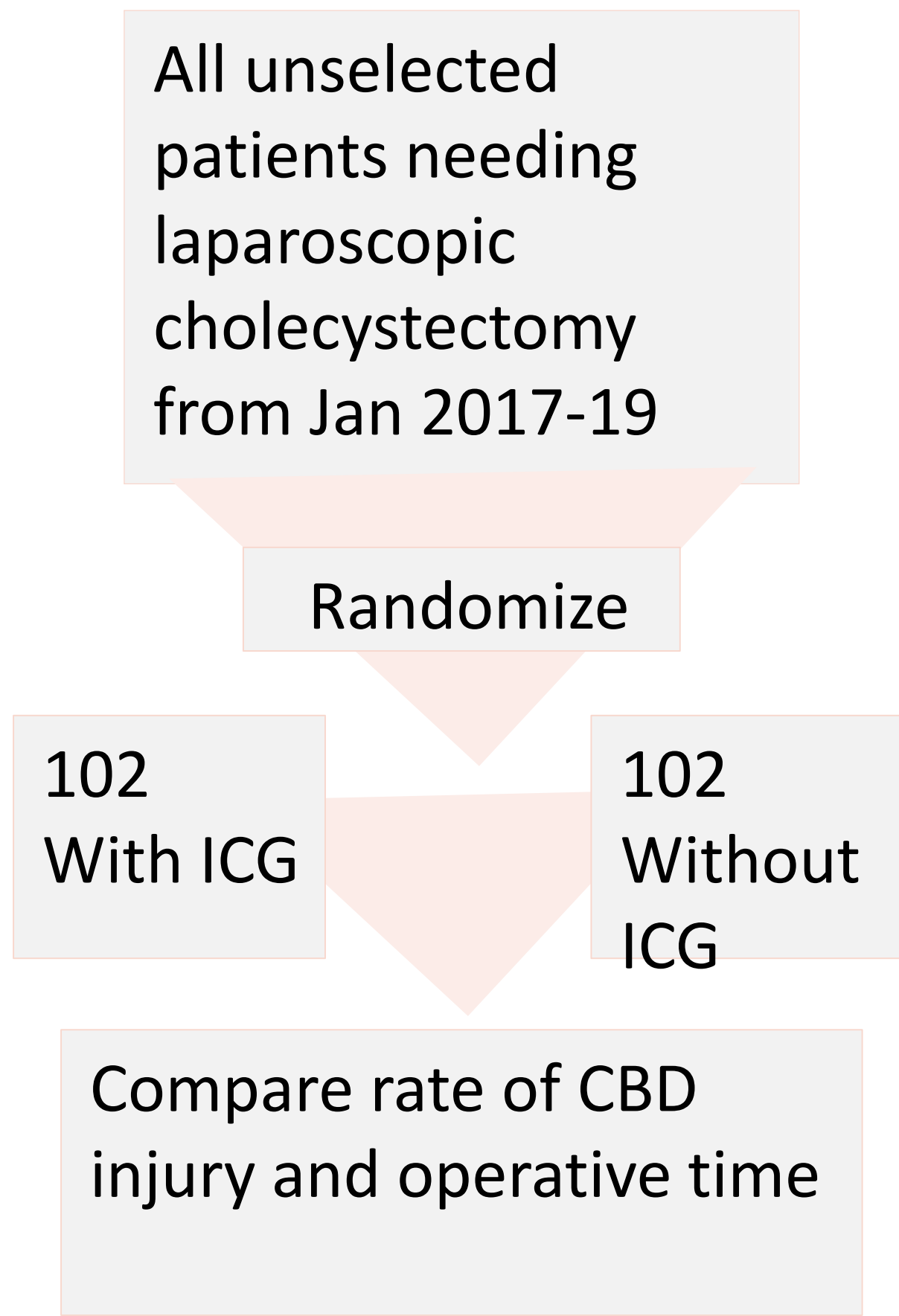
Aim: to compare the rate of CBD injury in groups with and without the use of ICG, during laparoscopic cholecystectomy

Methods: over a 2 year period beginning Jan 2017, all patients undergoing laparoscopic cholecystectomy were randomized to ICG and no ICG groups. ICG group patients received 2ml of 2.5mg/ml ICG, intravenously an hour prior to surgery. Laparoscopic cholecystectomy was then performed using near-infrared (NIR) scope for both groups. In ICG group switching to NIR mode showed fluorescence of extra-hepatic biliary tract. The operative time and rate of CBD injury of both groups were compared.

Results: 102 patients in each group were comparable in terms of age, ratio of male patients, body mass index, ASA grades and rate of complicated cholecystitis (acute/ acute or chronic cholecystitis, biliary pancreatitis, choledocholithiasis without signs of CBD stones at surgery or after endoscopic retrograde cholangiopancreatography (ERCP). The median operative time was 50 minutes in ICG group and 53 minutes in no-ICG group, with no significant difference between the two. There were no CBD injuries in either group.

Conclusions: ICG acts as a roadmap and provides early identification of extra-hepatic biliary anatomy and has the potential to add safety, though future studies with bigger sample size can reliably verify the hypothesis by comparing the actual CBD injury in each group. Conclusion on safety: Safe dissection is a basic surgical skill and cannot be replaced, but can be enhanced by technology (ICG fluorescence). Avoiding over-reliability on technology is an important warning as there is finite risk of pseudo-safety with increased risk of injury.

Characteristics	No ICG group	ICG group
Number of patients	102	102
Age, years, median	42 (12-62)	48 (20-67)
Males (percentage%)	33	35
Body mass index, kg/m2, median	28 (23- 35)	30 (22- 37)
ASA Score (percentage%) 1-2	78	75
ASA Score more than or equal to 3 (%)	22	25
Rate of complicated cholecystitis (percentage %)	32	37
Operative time (median, range) minutes	53 (30- 137)	50 (25- 124)
CBD injury	None	None
Comparable patient characteristics of each group		



Pics with ICG fluorescence to identify biliary anatomy

	Numbers	Percentage (%)
Total patients in ICG group	102	
Anatomy Identifiable prior to ICG (in normal light mode)	22	22
Anatomy Identifiable before dissection (in NIR (near infrared) mode)	62	61
Anatomy Identifiable after dissection (in NIR (near infrared) mode)	25	25
Total number with anatomy identifiable in NIR mode	87	85
Anatomy not identifiable (in NIR (near infrared) mode)	15	15
Pseudo-safety/ increased risk (dissecting close to bile duct, endangering safety of its vascularity)	2	2
Rate of visualization OR non-identifiability of anatomy in ICG group indicative of safety addition by use of ICG fluorescence		

Evaluation of safety: As CBD injury rate is as low as 0.5%, very large sample size needed to evaluate actual safety. Visualization and identification of correct anatomy is an indirect indicator of safety of procedure, by helping surgeon to reduce potential CBD injury:

Increased safety by use of ICG	No additional safety or Increased risk* by use of ICG
In 85% cases, anatomy identifiable by ICG fluorescence: acts as roadmap of biliary anatomy to increase safety by avoiding dissection close to bile duct and ascertaining the correct place of safe dissection	In 22% patients, anatomy identifiable in normal light without ICG, hence no additional safety expected by ICG use
Confirmation of anatomy: switching to NIR mode as many times as desirable throughout procedure, to confirm the correct, safe dissection, away from vital structures	In 15% patients, fluorescence was not obtained by ICG, (impacted stone, severe acute on chronic cholecystitis and empyema) Conventional dissection in normal light needed in such cases to reveal the critical view of safety.
	*Pseudo-safety/ increased risk: upon establishing the location of common bile duct by ICG, possibility of dissecting close to bile duct, endangering safety of its vascularity; happens in early learning curve though finite possibility of such event was 2%