

# Common bile duct injury during laparoscopic cholecystectomy in Ontario: Does ICD-9 coding indicate true incidence?

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## Abstract

**Background:** Recent reports in the scientific and lay press have suggested that bile duct injuries during laparoscopic cholecystectomy are common in Ontario. The reports were based on administrative data collected by hospital medical records departments and the Canadian Institute for Health Information (CIHI). The current study involved a direct inspection of hospital records to determine if the CIHI data accurately captured the rate of clinically significant bile duct complications.

**Methods:** For the period 1991 to 1995, records of bile duct injuries after laparoscopic cholecystectomy were independently evaluated to clarify the clinical significance of the complications. Of 21 Ontario hospitals for which data on complications had been reported in the media, 18 provided detailed information on all patients reported to have suffered bile duct complications classified by the hospital as "major." In addition, each institution provided information on a random sample of one-sixth of the patients who had suffered complications classified as "minor." The reviewer then examined each relevant hospital chart to assess the grade and significance of the reported complications.

**Results:** All 24 bile duct injuries classified by the hospitals as "major" were confirmed as major (clinically relevant) injuries. Of the 80 bile duct complications classified by the hospitals as "minor," 76 (95%) were irrelevant to patient outcome. The discrepancy between data collected and reported frequency of injury lies in the use of nonspecific coding methods.

**Interpretation:** The rate of significant bile duct injuries cannot be inferred from nonspecific codes taken from the *International Classification of Diseases*, ninth revision, and presented in hospital discharge records. Therefore, such data must be interpreted with extreme caution.

## Résumé

**Contexte :** Des comptes rendus publiés récemment dans la presse scientifique et populaire ont laissé entendre que les traumatismes infligés aux canaux biliaires au cours d'une cholécystectomie par laparoscopie sont répandus en Ontario. Ces comptes rendus étaient fondés sur des données administratives recueillies par des services des archives médicales des hôpitaux et l'Institut canadien d'information sur la santé (ICIS). L'étude en cours a comporté une inspection directe des dossiers d'hôpital pour déterminer si les données de l'ICIS ont saisi avec précision le taux de complications significatives des canaux biliaires.

**Méthodes :** Pour la période de 1991 à 1995, un évaluateur indépendant a analysé les dossiers portant sur des traumatismes des canaux biliaires consécutifs à une cholécystectomie par laparoscopie afin de clarifier la signification clinique des complications. Sur 21 hôpitaux de l'Ontario au sujet desquels les médias avaient publié des données sur les complications, 18 ont fourni des renseignements détaillés sur tous les patients qui auraient souffert de complications des canaux biliaires jugées «majeures» par l'hôpital. En outre, chaque établissement a fourni des renseignements sur un échantillon aléatoire 1/6 des patients qui avaient souffert de complications jugées «mineures». L'examineur a ensuite



## Evidence

## Études

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étudié chaque dossier pertinent pour évaluer le grade et la signification des complications signalées.

**Résultats :** Les 24 traumatismes aux canaux biliaires jugés «majeurs» par les hôpitaux ont été confirmés comme traumatismes majeurs. Sur les 80 complications des canaux biliaires jugées «mineures» par les hôpitaux, 76 (95 %) n'avaient aucun lien avec le résultat pour le patient. L'écart entre les données recueillies et la fréquence signalée des traumatismes est attribuable à l'utilisation de méthodes de codage non spécifiques.

**Interprétation :** On ne peut déduire le taux de traumatismes importants aux canaux biliaires à partir des codes non spécifiques tirés de la neuvième révision du *Classification internationale des maladies* et indiqués dans les dossiers de congé des hôpitaux. Il faut donc interpréter ces données avec une extrême prudence.

Laparoscopic cholecystectomy (LC) has become the standard surgical treatment for symptomatic cholelithiasis in the 8 years since its introduction into the specialty of general surgery. The operation offers the potential for the same endpoints as open cholecystectomy (i.e., removal of the gallbladder and stones with resultant relief of symptoms) but with demonstrated benefits of shorter hospital stay, smaller incisions, decreased need for analgesia and shorter time of convalescence relative to the open procedure.<sup>1</sup> However, various retrospective studies have suggested a higher incidence of complications, especially the most feared, iatrogenic bile duct injury.<sup>2-6</sup> The hospital discharge abstracts routinely compiled by health records personnel are helpful for tracking such complications and were used in a 1996 study published in this journal.<sup>7</sup> That article outlined changes in practice patterns in Ontario as a result of the introduction of LC, examining several parameters for the period 1989-1990 to 1993-1994. Over this period, the number of cholecystectomy procedures increased by 30.4%, the number of patients with chronic gallstone disease increased by 33.6%, and the number who underwent elective surgery increased by 48.3%. LC was performed in only 1% of cases in 1990-91, but this proportion had increased to 85.6% by 1993-94. The rate of bile duct injury from both laparoscopic and open cholecystectomy tripled from 0.3% to 0.9% over the 5-year period. Two of the same authors later repeated and updated this analysis,<sup>8</sup> finding institutional variation in rates of "bile duct injury" among hospitals but no relation between the rate of injuries and the volume of surgery performed. These 2 articles relied solely on hospital discharge abstracts and inferred the presence of "bile duct injuries" from the use of nonspecific codes from the *International Classification of Diseases*, ninth revision (ICD-9);<sup>9</sup> however, the authors did acknowledge that the available codes could not distinguish minor from major injuries.

A report in the print media on Sept. 21, 1997,<sup>10</sup> drawing directly on the methods of the *CMAJ* publication<sup>7</sup> and based on Canadian Institute for Health Information

(CIHI) data specifically derived from ICD-9 codes, stated that the total number of bile duct injuries in Ontario for the period 1991 to 1995 was 938. Twenty-one hospitals (those with the highest overall injury rates) were listed, along with the incidence of bile duct injuries culled from the CIHI data. These hospitals accounted for 480 of the 938 reported injuries. All of these 21 hospitals subsequently reviewed the cases in question and raised concerns about the interpretation of the complications data reported in the newspaper article. I therefore carried out an independent review of bile duct injuries in the province to clarify the clinical significance of biliary complications after LC reported by Ontario hospitals for the period 1991 to 1995.

## Methods

The 21 hospitals mentioned in the newspaper report re-examined the medical records of all patients who had undergone LC between January 1991 and December 1995 and whose records included one of the complication codes given in Appendix 1 (from the clinical modification of the ICD-9, as presented in the annual hospital version educational annotation<sup>11</sup>). The hospitals assessed each complication as clinically relevant or not clinically relevant.

For the purposes of this review, the 21 hospitals were asked to provide medical records for all patients with a clinically relevant complication. In addition, the medical records department of each hospital was asked to randomly select one-sixth of those without a clinically relevant complication for inclusion in the study.

The hospitals responding to this request provided the original operative note, the discharge summary, the pathology report from the initial admission, the dates of transfer, any subsequent operative notes (if applicable) and the referral notes from specialists seen subsequently (if applicable), including final notes from those admissions. All patient, physician and hospital identifiers were removed.

Each record was then reviewed, and the complications



of LC were classified according to the scheme given in Table 1.

## Results

During the period under review, a code or series of codes representing a complication of LC was recorded for a total of 480 patients at the 21 hospitals. All but 3 of the 21 hospitals provided information from their medical records. The 3 hospitals who did not participate accounted for 54 (11%) of the patients with complications.

The reporting hospitals provided information for 24 patients who had suffered what they classified as clinically relevant injuries and 80 who had suffered clinically irrelevant injuries.

After reviewing the records, I classified 18 of the 24 clinically relevant injuries as grade I and 6 as grade II. Of the 80 injuries classified by the hospitals as clinically irrelevant, I classified none as grade I, 1 as grade II, 3 as grade III, 71 as grade IV and 5 as grade V. Virtually all of the injuries classified as grade IV consisted of inadvertent incision or puncture into the gallbladder and leakage of small amounts of bile from the organ during or after its removal from the gallbladder bed. It can be safely assumed that such problems were indeed inconsequential, because the length of stay for all of these patients was 1 or 2 days; there was no information about readmission in any case. The grade II injury involved insertion of a T-tube into an avulsed cystic duct. The grade III injuries were a small bile duct leak, which was successfully treated with a nasobiliary drain; a small, self-limited cystic duct leak; and a small cystic duct leak, which was corrected with a suture during a second procedure. For the grade V injuries, the operative notes made no mention of bile leaks during the procedure, but the pathologist observed a tear in the gallbladder. It was not clear whether these cases involved incomplete operative notes or the opening of the gallbladder either at the completion of surgery (to facilitate its

removal from the subumbilical incision) or after it had been removed from the body.

Thus, of the 80 records classified as clinically irrelevant by the hospitals, my review indicated that only 4 (5%) had some clinical relevance (injuries of grades I to III).

The classification of the 104 records reviewed and their coded complications are shown in Table 2. The most common combination was 998.2 and E870.0, and of these 60 cases, 15 involved grade I or II injuries. The second most common combination was 998.2 and E878.6, and of these 17 cases, 5 involved grade I injuries. Code 998.2 was used alone 14 times; one of these injuries was grade I and another was grade II.

## Discussion

Of the 104 records submitted for review, 28 had complications that were graded as clinically relevant. If these findings are extrapolated to the entire sample of 426 patients with a complication of LC at the 18 hospitals providing information for the review, it is possible that only 44 had a clinically relevant complication, which represents about 10% of the injuries recorded in the CIHI data set. The remainder of the reported complications were small tears in the gallbladder that occurred during removal, or they were coding errors. As shown in Table 2, a variety of codes were used to represent the same complications, and none of these codes, individually or in combination, clarified the clinical significance of the complications.

Injury to the common duct varies significantly in severity and long-term implications, whereas injury to the gallbladder (the vast majority of the injuries reported) is almost always inconsequential, given that the gallbladder is the organ that is removed during LC.

The interpretation of such data is critical: if nonspecific codes are interpreted as indicating major injuries, as they were in both scientific<sup>7,8</sup> and lay<sup>10</sup> publications, it will be

**Table 1: Grading of clinical severity of bile duct injuries**

Grade	Description
I	Major bile duct injury, with possibly serious morbidity over the short or long term (or both) <sup>12-14</sup> (e.g., transection of bile duct requiring re-anastomosis or a second operation and repair)
II	Major bile duct injury but unlikely to cause serious or long-term morbidity (e.g., local injury requiring intubation with a T-tube)
III	Condition requiring further treatment with no significant long-term effects (e.g., cystic duct leak with no injury to bile duct)
IV	Condition irrelevant to patient outcome (e.g., small tear in gallbladder on removal of organ)
V	Possible coding error (e.g., no mention of problems in the operative note, but a tear in the gallbladder noted on pathological examination)

**Table 2: Number of patients according to codes from the clinical modification of the *International Classification of Diseases, ninth revision*<sup>11</sup> appearing on hospital discharge abstracts and grade of injury (as determined by review)**

Code	Grade of injury; no. of patients					Total
	I	II	III	IV	V	
998.2 alone	1	1		11	1	14
998.2, E870.0	10	5		42	3	60
998.2, E878.6	5		1	11		17
998.2, E870.9					1	1
998.2, E878.8	1			3		4
998.2, E870.0, E878.8		1		3		4
868.0, E870.0	1		1			2
998.2, E876.9				1		1
998.2, E870.0, 868.02			1			1
Total	18	7	3	71	5	104



concluded that the rate of bile duct injury is high, but this conclusion would appear to be suspect.

This study had some limitations. The hospitals were not given precise instructions on how to randomly sample the records of clinically irrelevant injuries. It is therefore possible that they did not select the records randomly and may have held back records that revealed complications that I would have classified as clinically relevant. In addition, I am a general surgeon who specializes in hepatobiliary and pancreatic surgery and might therefore be seen to have a subjective bias. However, this theoretical disadvantage was outweighed by the necessity of having someone familiar with the field carry out the review. Finally, I could not be totally blinded as to the hospitals involved, although attempts were made to preserve the anonymity of the hospitals as much as possible.

Ideally, there should be no major bile duct injuries after LC. The total number of major injuries for the 18 hospitals reviewed here (a potential maximum of 44 or 10% of the number of injuries reported in the media) is encouraging and represents a low frequency of such injuries in Ontario, given the number of operations performed. However, the number of injuries reported represents those recognized early; in a small number of cases, postoperative stricture does develop after an apparently uncomplicated procedure.

The real incidence of major bile duct injury after LC in Ontario is unclear. If the data here are representative of the province as a whole, then the real complication rate resulting in clinically relevant misadventure for the patient is approximately 10% of the rate noted in the CIHI data set and previously reported. If the reported frequency in Ontario is 11.6 for every 1000 procedures (1.16%),<sup>8</sup> then the expected clinically relevant rate is only 1.2 for every 1000 procedures.

A nationwide Danish series for the same period<sup>2</sup> reported 6.3 major bile duct injuries per 1000 procedures, and the Norwegian National Cholecystectomy Registry<sup>5</sup> reported 6.1 injuries requiring treatment per 1000 procedures. Interestingly, the rate in Norway for open cholecystectomy during the same period was 7.4 major injuries per 1000 procedures. No comprehensive Canadian data are available. However, because interprovincial standards of surgical training are so well articulated and monitored by the Royal College of Physicians and Surgeons of Canada and because the Canadian Association of General Surgeons<sup>15</sup> (along with the Society of American Gastrointestinal and Endoscopic Surgeons<sup>16</sup>) was active at an early stage in establishing guidelines for laparoscopic training in Canada, it may be reasonable to assume that rates of major complications are consistent throughout the country.

The national studies in Denmark and Norway and the

data in this review illustrate that the rate of major bile duct injury during LC is unlikely to be higher than the previously reported rate for open cholecystectomy.<sup>7</sup>

The ICD-9 coding issue raised by this review is crucial. The 998.2 code is nonspecific, and the other codes listed do not differentiate between an injury to the common duct and an injury to the gallbladder. In addition, they do not differentiate between clinically relevant and clinically unimportant complications. Further classification of the complication codes should be considered to differentiate major from minor injuries (including differentiation of injuries to the gallbladder and cystic duct from injuries to the common bile duct).

During the course of the review, 2 questions recurred: What advantage could there be for "aggressive" coding of nonspecific and clinically irrelevant complications? Is there an advantageous budgetary impact for hospitals who engage in such coding? I did not address these questions further.

This review has shown that rates of clinically relevant mishaps after LC cannot be accurately determined from the codes currently used by hospitals. Modifications to CIHI coding procedures should be considered, so that these data will be more useful. Data derived from nonspecific complication codes should be interpreted with caution, and it should be appreciated that the codes may not accurately reflect the clinical significance of in-hospital events.

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**Appendix 1: Codes from the clinical modification of the *International Classification of Diseases*, ninth revision (hospital version educational annotation)<sup>11</sup> defining intra- and post-operative complications**

998.2	Accidental puncture or laceration during a procedure on a blood vessel, nerve, or organ
E870.0	Accidental cut, puncture, perforation, or hemorrhage during medical care — surgical operation
E878.6	Surgical operation and other surgical procedures as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at the time of operation — removal of other organ
E878.8	Surgical operation and other surgical procedures as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at the time of operation — other specified surgical operations and procedures
868.0	Injury to other intra-abdominal organs — unspecified intra-abdominal organ (868.02: bile duct and gallbladder)
E870.9	Accidental cut, puncture, perforation or hemorrhage during medical care — unspecified medical care
E876.9	Other and unspecified misadventure during medical care — unspecified

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