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## Decision-Making in Patients with Gallstones: Development of a Clinical Algorithm Using the Instrument of a Consensus Development Conference

### Key Words

Gallstones  
Decision-making  
Algorithm  
Medical dissolution  
Surgical treatment  
Laparoscopic cholecystectomy

### Abstract

Since decision-making in patients with gallstone disease is a very common medical problem, a carefully planned consensus development conference was held to develop a clinical algorithm using an electronically transmitted group response of the panel and the general audience. Only symptomatic patients are candidates for treatment. Minimal diagnostic requirements are ultrasound, determination of leukocytes, alkaline phosphatase and bilirubin in the blood, and preoperative intravenous cholangiography. Detected common duct stones should nowadays be removed by endoscopic retrograde cholangiopancreatography. Symptomatic gallbladder stones are managed by laparoscopic cholecystectomy as the new standard treatment. Conventional cholecystectomy should be done in patients with liver cirrhosis and portal hypertension, suspicion of cancer, certain cases of severe, acute or chronic inflammation, severe adhesions in the upper abdomen and pregnancy. Medical stone dissolution and extracorporeal shock-wave lithotripsy should be restricted to a small group of patients with a high surgical risk and who have small, roentgen-negative stones and a patent gallbladder.

### Introduction

The worldwide explosion in information, technical equipment, and costs for medical care has made mandatory quality assurance and audit programs a vital challenge for national and international health care systems [1].

At first glance, results from randomized controlled clinical trials, as the highest standard of scientific objectivity, seem to be the main stream for defining standards. However, they answer too few questions in the complex flow of clinical decision-making; they are frequently open to methodological criticism and to the general problem of external validity [2], and their results are rarely introduced into direct routine decision-making. Another ex-

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treme for setting standards is the judgment of an outstanding expert who is so powerful in a medical community that almost all its members have to follow his path of decision-making [3]. This situation is very unusual in a democratic society and no longer consistent with the overload of knowledge and technology in our time [4]. Hence other procedures for solving collective decision problems have to be applied to set standards or practice guidelines which fulfill at least two conditions: they must include a formalized way of seeking advice [5], and this way must be acceptable to people working in social sciences to give it a satisfactory degree of scientific validity. Among others two methodologies have been developed or applied in clinical medicine in the last 10 years which fulfill these demands: consensus development conferences [6] and clinical practice guidelines [7]. The first includes a panel of experts and a large number of participants, the latter are collected in a nominal group process [8] by a restricted number of peers.

Since decision-making in patients with gallstones is a very common surgical problem, the Permanent Working Party on Clinical Trials (CAS) has chosen it for an experiment to develop practice guidelines in gallstone disease. This experiment combined the two methodologies: a carefully planned consensus development conference [9], and the production of a clinical algorithm by an electronically transmitted group response of both the members of the panel and the general audience as an element of the Delphi method [5].

### Methods and Participants in the Consensus Conference

The course and structure of the conference in Frankfurt followed that of a European model as developed for technology assessment [10]. The five basic processes of such a group consensus development were performed as follows.

#### *Planning Committee*

The issue in need of evaluation was identified by the general assembly of the CAS in Munich in November 1990, which also nominated the planning committee. This group, consisting of expert surgeons in particular fields and methodologists for clinical trials, met in Stuttgart in July 1991, and proposed the questions for the meeting, the speakers and the panel.

#### *Panel*

The panel in the November conference consisted of speakers who were experts in concepts and methods on standards: G. Carstensen (Mühlheim/Ruhr) for surgery; H.K. Selbman (Tübingen) for statistics and quality assurance, and H.L. Schreiber (Göttingen) for legal sciences. Furthermore, speakers were included who were experts in

the treatment of cholelithiasis: O. Boeckl (Salzburg) for conventional, open cholecystectomy; H.D. Becker (Tübingen) for laparoscopic cholecystectomy; W. Rösch (Frankfurt), physician for conservative treatment of gallstones, including chemical litholysis and extracorporeal shock-wave lithotripsy (ESWL), and D. Schröder (Frankfurt) for acute cholecystolithiasis. The panel was completed by general practitioners: H. Hamelmann (Kiel); C. Herfarth (Heidelberg) for surgery, and W. Lorenz (Marburg) for clinical trial methodology.

#### *Questions Defined before the Meeting and Participants of the Auditorium*

The planning committee prepared 10 questions prior to the meeting. Before the meeting they were sent to the panel and to a company (Lux AV, W-3505 Lohfelden) which provided the technical equipment for the conference to permit an electronically transmitted group response of all panelists and separately of all members in the auditorium to each of the questions.

The auditorium consisted of 62 participants including 24 surgeons with consultant level, 17 surgeons, 11 surgical trainees and 10 basic scientists.

#### *Conducting the Conference*

The meeting lasted for 1 day (November 15, 1991). First, the main reports (20 min) of speakers, who were experts in concepts and methods on standards (see Panel section), were presented. Then the experts in the treatment of cholelithiasis delivered their knowledge and judgement in the same sequences as given in the Panel section. The same discussion time was provided for each of the reports as that for the presentation of each of the papers. After a prolonged pause for an individual exchange of ideas and arguments, special reports (10 min) were presented on the aspects of treatment and prognosis of cholelithiasis, which were regarded as important for developing the clinical algorithm by the planning committee: perioperative risk analysis; respiratory function during both endoscopic and conventional cholecystectomy; release of mediators by stress and injury and postoperative pain and recovery; the measurement of learning by variations of operation time; the preoperative situation of patients in hospitals with different levels of care delivery; the present status of ESWL; minilaparotomy, and special treatment modalities via a surgical rectoscope (for details see a previous report on the methodology [9]).

Finally the clinical algorithm was developed in a 2-hour period by all members of the conference. For this purpose, electronic voting was implemented with a keyboard at each place provided for the audience. Before presentation of the algorithm, the chairman of the conference (H.G. Beger) emphasized that it is absolutely necessary not to lose track of the individual case in connection with the subsequent presentation of the clinical algorithm. Its development for a typical, paradigmatic clinical scenario should not lead to its uncritical and schematic application in individual patients.

The algorithm was presented by the chairman of the planning committee (M.W. Büchler). It had been prepared as a draft by him and the planning committee in its session in July. Each step in the flow diagram (fig. 1) including clinical state boxes, decision boxes and action boxes [11, 12] was discussed. In this regard the 10 questions were formally proposed to the members of the panel and the audience. The answers from the two bodies of the conference were analyzed separately. A single step in the algorithm was accepted if a majority (>50%) of the panel and the audience did not reject it. The final algorithm is included in the consensus statement. It contains all



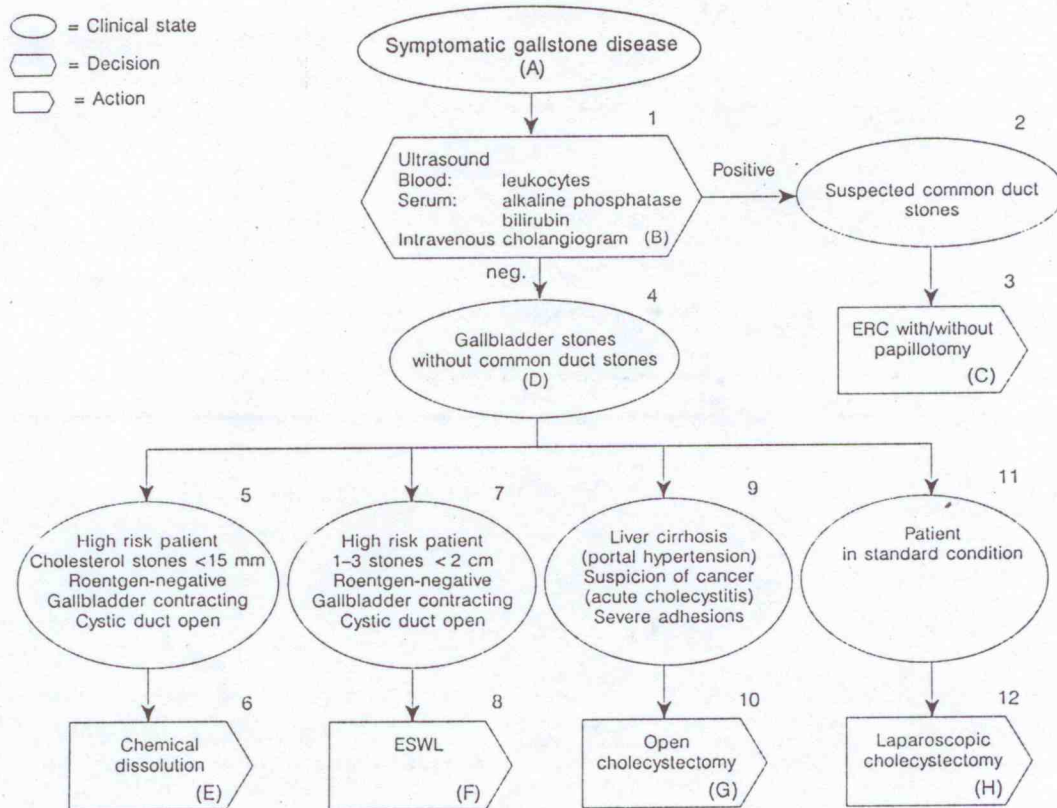


Fig. 1. The clinical algorithm for symptomatic gallstone disease. ERC = Endoscopic retrograde cholangiography.

three characteristic sorts of definitions that may be found in a clinical algorithm: (1) definition of a clinical state; (2) definition of a diagnostic decision, and (3) definition of a therapeutic decision [11].

### Consensus Statement

#### *Decision-Making in Patients with Symptomatic Gallstone Disease: Annotations to the Algorithm*

##### *Prevalence of Gallstone Disease and Natural Course*

The prevalence of cholelithiasis has been shown to be around 10% for females younger than 50 years as opposed to 25% in older women. In men the figures are 5% under 50 years and 10–15% in the older group [13–22]. The cumulative incidence within 5 years has been demonstrated to be between 0.3 and 3.7% [13, 23].

Two thirds of gallstones are asymptomatic [18a, 18b, 24, 25]. In a follow-up investigation of patients with asymptomatic gallstones 18% developed upper abdomi-

nal symptoms within 15 years [17]. In other words only 1–4% of asymptomatic 'patients' will develop symptoms or a complication of gallstone disease per year [26]. The risk of newly developing symptoms decreases within time [17] and after 15 years of not having gallstone symptoms, they usually do not appear in the further course of the disease [27]. In contrast, patients with symptoms of gallstone disease have a 50% risk of reexperiencing upper abdominal colics [28, 29] and are more likely to develop complications than asymptomatic patients. The risk per year of developing gallbladder carcinoma during gallstone disease appears to be 0.1% [26].

##### *Signs and Symptoms of Gallstones*

It is of utmost importance to differentiate between symptomatic and asymptomatic gallstones because the indication for any treatment is based upon the presence of symptoms [30, 31].



It has been clearly shown that so-called dyspeptic complaints such as nonspecific upper abdominal pain, fullness, meteorism, nausea, vomiting, fat intolerance, diarrhoea as well as constipation occur in comparable frequencies in patients with and without gallstones [32–35]. Therefore the term 'symptomatic gallstone' must be defined avoiding all kinds of nonspecific upper abdominal complaints. We define a symptomatic gallstone as the cause of severe pain in the right hypochondrium or in the epigastrium, lasting 15 min to 5 h, and often waking the patient at night. The symptoms disappear spontaneously or on spasmolytic therapy [36, 37]. There is general agreement that only patients with symptomatic gallstones are candidates for treatment including surgery [38–40]. For persons with asymptomatic gallstones, watchful waiting is the best course because the natural history is so benign that treatment is generally not recommended [25].

#### *Obligatory Diagnostics*

A patient presenting with clinical signs of gallstone disease nowadays undergoes ultrasound examination as the first step and the best choice of noninvasive diagnostics [20, 41–45]. It has been shown that the presence of gallstones in the gallbladder is accurately estimated by ultrasound in 74–96% of cases [44, 45]. Besides information about gallstones, ultrasound provides data on the wall of the gallbladder (acute cholecystitis, >4 mm in chronic cholecystitis) and gives information on the common bile duct. However, the accuracy in detecting common bile duct concretions appears to be only approximately 30% [45]. The minimum blood or serum analysis in the management of a gallstone patient includes blood leukocytes to check the degree of inflammation, and serum alkaline phosphatase and total bilirubin to see whether the common bile duct is obstructed by additional stones.

Also, since laparoscopic cholecystectomy has become the routine standard procedure for elective gallbladder stones, an intravenous cholangiography should be part of the diagnostic workup [45, 46]. Intraoperative routine cholangiography has become a matter of debate [47, 48] and this is why we think that preoperative routine intravenous cholangiography is an easy and noninvasive method to select patients for endoscopic retrograde cholangiopancreatography, also because of its high accuracy in detecting common bile duct stones in over 90% of all cases [45] with the possibility of removing them endoscopically prior to operation. Nowadays many surgeons are in favor of routine intraoperative cholangiography during laparoscopic cholecystectomy. The goal of the examination is no longer only the detection of unsuspected common bile

duct stones, but also the visualization of anatomical variations in the bile ducts to prevent bile duct injuries [49]. In this regard controversy persists and the standard management is not yet established.

#### *Common Bile Duct Stone Management*

Common bile duct stones are known to be found in approximately 10% of patients with cholelithiasis under 60 years of age [45, 50, 51], and in 15–60% of patients over 60 years of age [26]. If ultrasound, intravenous cholangiography and/or the serum cholestasis indicators raise suspicion of common bile duct stones, endoscopic retrograde cholangiography with facultative papillotomy is mandatory. By this means and including ESWL as well as local shock-wave lithotripsy [52–54] the endoscopist is able to treat 90–95% of common bile duct stones without the need of surgery [55–58]. Furthermore, it has been shown that selective preoperative endoscopic retrograde cholangiopancreatography and stone removal have very low morbidity and mortality in the laparoscopic treatment of complicated gallstone disease [59].

#### *Gallbladder Stone Management*

Having excluded common bile duct stones or having cleared the ductus choledochus by adequate endoscopic intervention, we face the alternatives for the treatment of gallbladder stones. Now and for the foreseeable future, laparoscopic cholecystectomy is the procedure of choice for treatment of symptomatic gallstones with the alternatives of medical dissolution, ESWL and conventional (laparotomy) cholecystectomy.

#### *Medical (Oral) Dissolution of Gallbladder Stones*

Medical litholysis is possible using chenodesoxycholic acid in combination with ursodesoxycholic acid perorally. However, because of the possible side effects, chenodesoxycholic acid has largely been supplanted by ursodesoxycholic acid. In summary only 5–20% of all gallstone patients are suitable for this treatment [60–66] because of the strict inclusion criteria. These are cholesterol stones (roentgen negative and floating on cholecystography), smaller than 15 mm in size, localized in a functioning (contracting) gallbladder with an open cystic duct. Under these conditions within 1–3 years the mean dissolution rate is approximately 70% [60, 62–64]. The disadvantages of oral litholysis are patient selection, long treatment time and a recurrence rate 2–5 years after successful lysis of 25–50% (solitary stones recur less often than multiple ones) [66, 67]. From a surgical point of view only high risk patients with a considerable comorbidity and patients



who choose to avoid operation should be selected for this long-term medical treatment which can also cause side effects such as diarrhea and increased liver enzymes. There are some newly developed techniques of direct litholysis using methyl-tert-butyl ether [68-71]. These approaches are invasive and are still experimental techniques with considerable morbidity and stone recurrence as high as known for oral litholysis [71]. With regard to the rapidly growing experience and standards in performing laparoscopic cholecystectomy, direct ether lysis seems to be an obsolete treatment.

#### *ESWL of Gallbladder Stones*

The fascinating idea of noninvasive shock-wave lithotripsy of gallstones, which held out great hope at the beginning [72-75], is now also being restricted to a very selected group of patients [46, 76].

Not more than 10-20% of all symptomatic gallbladder stone patients fulfill the strict inclusion criteria for ESWL [77, 78], which are a radiolucent cholesterol-rich solitary gallbladder stone up to 20 mm in diameter in a well-contracting gallbladder with an open cystic duct. Within this small group of patients 80% are stone free after 1 year [46, 72-77, 79]. Patients with multiple (up to 3) and larger stones (up to 30 mm in diameter) have a success rate of only 30-50% within 6-12 months [80]. Again these patients generally need an additional long-term treatment with medical litholysis for 8-10 months, and the recurrence of stones, which is frequently associated with the recurrence of biliary pain, occurs in about 23-30% of the patients after 5 years [80, 81].

#### *Conventional Cholecystectomy*

110 years ago the first cholecystectomy was carried out by laparotomy [82]. Since then this procedure has become a highly standardized method all over the world. Elective conventional cholecystectomy can nowadays be carried out without mortality and a morbidity of around 5% [48, 83-87b]. Although conventional cholecystectomy has gained this favorable standard, laparoscopic cholecystectomy has won the game because it has a smaller operative trauma with all the resulting consequences [88]. Therefore the indication for conventional cholecystectomy is restricted to patients with suspected cancer of the gallbladder, certain cases of severe, acute or chronic inflammation, liver cirrhosis with portal hypertension, pregnancy, severe upper abdominal adhesions following previous surgery, in patients with cholecystoenteric fistulas and in higher risk patients with advanced biliary tract disease [26].

#### *Laparoscopic Cholecystectomy: The Standard Treatment*

Since the introduction of laparoscopic cholecystectomy in 1987 [36, 76, 88-97b] this procedure has initiated a revolution in general surgery. Meanwhile more than 80% of all elective cholecystectomies are performed laparoscopically in hospitals using this technique [91, 98]. However, this procedure is restricted by morbid obesity, cardiopulmonary diseases, Mirizzi syndrome, empyema of the gallbladder and a contracted gallbladder as relative contraindications, including severe acute or chronic inflammation and patients who have undergone upper abdominal surgery [26, 99]. A suspected cancer of the gallbladder, liver cirrhosis with portal hypertension, severe coagulopathy, cholecystoenteric fistulas and pregnancy (1st and 3rd trimester) are seen as absolute contraindications for laparoscopic treatment [26, 99]. Acute cholecystitis may also be treated by laparoscopic cholecystectomy, but the safety and timing of surgery should be conclusively evaluated [100]. The intraoperative conversion rate to conventional (open) cholecystectomy is around 5-8% because of adhesions, acute cholecystitis or bleeding complications in most cases [99, 101, 102]. In comparison with open cholecystectomy the patients experience less pain, less postoperative morbidity (pulmonary afflictions) and a dramatically shortened stay in the hospital [88, 98, 103-109] due to the smaller trauma. Also the more convenient and more cosmetic scar situation postoperatively has influenced the willingness of patients to have this operation. Interestingly laparoscopic cholecystectomy passed open cholecystectomy before the scientific data showing the superiority of the former procedure were elaborated, indicating the real advantages of this new operation. Although the operative mortality associated with laparoscopic cholecystectomy is less than that with open cholecystectomy [110], a major concern with the laparoscopic approach is an increase in the incidence of bile duct injury [100, 102]. Clearly, this problem has to be solved in the future. Future research should focus on refining the technique of laparoscopic cholecystectomy to maximize safety.

#### **Discussion and Conclusions**

A clinical algorithm for decision-making in gallstone disease has been developed using the instrument of a consensus development conference of the CAS for defining standards in surgery [9]. Mullen and Jacoby [6] have shown that a carefully planned consensus development



conference can serve as a robust model for group decision-making processes. The Institute of Medicine [111] has described the following 8 attributes of good practice guidelines: validity; reliability; clinical applicability; clinical flexibility; clarity; multidisciplinary process; scheduled review, and documentation. Our presented algorithmic map guideline, which has been developed using extensive review of the literature and the structured group process technique, fulfills 6 of the 8 Institute of Medicine attributes. However, the reproducibility of the guideline development and the reliability of processing clinical data have not been determined or verified. In addition, Margolis et al. have started a 3-year joint research project on the practice guideline reliability in surgery, but the data are not yet available. However, similar treatment recommendations in gallbladder disease have also been established by the American College of Physicians [112] and the NIH consensus development conference [26] showing partial reproducibility with our clinical algorithm. It is clear that because of scientific flow, therapeutic recommendations have to be adapted from time to time. We believe that repeated consensus development conferences are a good platform to prove and change therapeutic modalities if they are followed by clinical trials. Therefore the authors are planning an international meeting on gall-

stone disease which will take place in Berne in May 1995. Following our last conference we conclude that laparoscopic cholecystectomy nowadays represents the standard procedure for symptomatic gallbladder stones. There are only a few contraindications for this operation. In these cases and after weighing the relative contraindications, open cholecystectomy still plays a part in treatment management and represents a standard to which other treatment modalities have to be compared. The techniques of both laparoscopic and open cholecystectomy have the advantage over other approaches of eliminating not only the gallstones but also the gallbladder, thereby preventing recurrence of the disease. Before treating the gallbladder, common bile duct stones should be excluded or extracted endoscopically. A small group of well-selected patients who prefer noninvasive treatment or have a high surgical risk can alternatively be treated by conservative dissolution methods including ESWL with the disadvantage of long-term treatment, less efficacy and a recurrence rate.

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