



A randomised controlled trial comparing laparoscopic cholecystectomy with observation/conservative management for preventing recurrent symptoms and complications in adults with uncomplicated gallstones. (C-Gall trial)

## PROTOCOL

A UK Collaborative Trial funded by the HTA  
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## Signature

The Co-Clis agree to abide by this protocol

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**VERSION HISTORY:**

<b>Amendment no.</b>	<b>Protocol version no.</b>	<b>Description of changes (<i>incl. author(s) of changes</i>)</b>	<b>Date Effective</b>
	Version 1.0	New Document	08 April 2016
	Version 2.0	<i>Amended as part of provisional opinion</i>	20 May 2016
	Version 3.0	Revisions to protocol following initial recruitment and first Trial Steering Committee meeting.	10 October 2016
	Version 4.0	Revisions to document replacing conservative/ observation management to medical management throughout	14 June 2017
	Version 5.0	Revisions to protocol relating to consent procedures for audio recording of recruitment conversations (Eilidh Duncan) Updates to safety section (section 4) Reorder reference sections	14 December 2017
	Version 6.0	Revision to follow up period Revision to recruitment period	15 March 2019
	Version 7.0	Add text about questionnaire reminders	08 August 2019

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## PROTOCOL SUMMARY

<b>Question addressed</b>	Is there any difference between *observation /conservative management and cholecystectomy in terms of participant quality of life and cost-effectiveness in terms of incremental cost per QALY?
	*Throughout protocol we refer to observation/ conservative management as medical management
<b>Considered for entry</b>	All adults with symptomatic uncomplicated gallstone disease who are referred to a secondary care setting and considered suitable for cholecystectomy.
<b>Populations</b>	Adults with symptomatic uncomplicated gallstone disease
<b>Trial entry</b>	Eligible and consenting male and female adult patients.
<b>Interventions</b>	1. Laparoscopic cholecystectomy  2. Medical management with analgesia, as required, and dietary advice
<b>Outcome assessment</b>	The patient reported outcomes (SF-36; CSQ) will be assessed by participant-completed questionnaires at baseline, 3, 9, 12,18 months and 6 monthly thereafter, post randomisation, till end of trial.
<b>Co-ordination</b>	<b>Local:</b> by local surgical teams, local Research Nurse or Recruitment Officer. <b>Central:</b> by Trial Office in Aberdeen (Telephone 01224 438089).  <b>Overall:</b> by the Project Management Group and overseen by the Steering Committee and the Data Monitoring Committee.

<b>GLOSSARY OF ABBREVIATIONS</b>	
AE	Adverse Event
AUC	Area under the curve
AUGIS	Association of Upper Gastrointestinal Surgeons
BNF	British National Formulary
CBD	Common bile duct
CEAC	Cost-effectiveness Acceptability Curve
CHaRT	Centre for Healthcare Randomised Trials
CI	Chief Investigator
CONSORT	Consolidated Standards of Reporting Trials
CRF	Case Report Form
CSQ	Condition Specific Quality of Life
CTU	Clinical Trial Unit
DCE	Discrete Choice Experiment
DMC	Data Monitoring Committee
GCP	Good Clinical Practice
GDPR	General Data Protection Regulation
GP	General Practitioner
GREPCO	Italian Group for the Epidemiology and Prevention of Cholelithiasis
HPB	Hepato-Pancreato-Biliary
HRQoL	Health Related Quality of Life
HSRU	Health Services Research Unit
HTA	Health Technology Assessment
ISD	Information Statistics Division
ISF	Investigator Site File
ISRCTN	International Standard Randomised Controlled Trial Number
IVR	Interactive Voice Response (randomisation)
MRC	Medical Research Council
NCT	National Clinical Trial
NHS	National Health Service
NHSG	National Health Service Grampian
NIHR	National Institute Health Research
NRES	National Research Ethics Service
NSAIDS	Nonsteroidal anti-inflammatory drugs
PI	Principal Investigator
PIL	Patient Information Leaflet
PMG	Project Management Group
PPI	Patient and Public Involvement
PQ	Participant Questionnaire
QALY	Quality Adjusted Life Year
RCT	Randomised Controlled Trial
R&D	Research and Development
REC	Research Ethics Committee
SAE	Serious Adverse Event
SAP	Statistical Analysis Plan
SD	Standard Deviation
SF36	Short form 36
SOP	Standard Operating Procedure
TMF	Trial Master File
TSC	Trial Steering Committee
UK	United Kingdom
UKCRC	United Kingdom Clinical Research Collaboration

## TRIAL PERSONNEL

### Co-Chief Investigators

- 1 Craig Ramsay (Programme Director HSRU)
- 2 Irfan Ahmed (Consultant HPB Surgeon)

### Grant Holders

- |   |   |   |  |
|---|---|---|--|
| 1 | Jane Blazeby (Professor of Surgery)                         | 6 | Katie Gillies (MRC Methodology Research Fellow)  |
| 2 | Graeme MacLennan<br>CHaRT Director                          | 7 | Bernie Croal (Patient and Public Representative) |
| 3 | Rodolfo Hernández (Health Economics Research Fellow)        | 8 | Peter Murchie (Academic GP)                      |
| 4 | Alison Avenell (Clinical Chair in Health Services Research) |   |  |
| 5 | Miriam Brazzelli (Senior Research Fellow)                   |   |  |

### Project Management Group (PMG)

This group is comprised of the grant holders along with representatives from the C-Gall central trial team:

- |   |                              |   |                          |
|---|------------------------------|---|--------------------------|
| 1 | Senior Trials Manager, CHaRT | 5 | C-GALL Data co-ordinator |
| 2 | Senior IT Manager, CHaRT     | 6 |                          |
| 3 | Quality Assurance Manager    | 7 |                          |
| 4 | C-Gall Trial Manager         | 8 |                          |

### Trial Steering Committee (TSC) Members

The membership of this committee comprises of four independent members along with the Chief Investigators (Ahmed/Ramsay) or a nominated delegate. The other C-GALL grant-holders and key members of the central office (e.g. the trial manager) may attend TSC meetings.

#### *Independent TSC Members*

- |   |                     |   |  |
|---|---------------------|---|--|
| 1 | David Beard (Chair) | 3 | Ian Beckingham (Consultant Surgeon)        |
| 2 | Dee McDonald (PPI)  | 4 | John Leeds (Consultant gastroenterologist) |

### Data Monitoring Committee (DMC) Members

This committee is comprised of three independent members and the trial statistician contributes as appropriate. The CI and/or a delegate may contribute to the open session of the meetings as appropriate.

1	Catherine Hewitt	3	Tim McAdam
2	Jon Lund	4	

**Trial Office Team**

1	Co-Chief Investigators	5	Senior Trials Manager
2	CHaRT Director	6	Senior IT Manager
3	Trial Manager	7	Trial statistician
4	Data Co-ordinator		

# C-Gall

## 1. INTRODUCTION

### 1.1 Background

Gallstone disease (cholelithiasis) is one of the most common gastrointestinal disorders in industrialised societies. Clinical surveys conducted in Europe, North and South America, and Asia indicate that the prevalence rates for gallstone disease range from 5.9% to 25%<sup>1-4</sup> and tend to increase with age. A clinical ultrasound survey conducted in the UK reported prevalence rates of 12% among men and 22% among women over 60 years of age.<sup>3</sup> A multicentre population-based study conducted in Italy has reported an incidence of gallstone disease of 0.67% per year (0.66% in men and 0.81% in women).<sup>5</sup>

Natural history studies have shown low mortality from gallstone disease with typically less than 1% of people dying from gallbladder-related causes.<sup>6</sup> In a recent population-based study the overall frequency of symptom development in asymptomatic people was around 20% over a long follow-up period (mean 8.7 years).<sup>6</sup>

In people with symptomatic uncomplicated gallstone disease, the annual rates of developing complications have been reported to be as low as 1 to 3%.<sup>7-9</sup> The Italian Group for the Epidemiology and Prevention of Cholelithiasis (GREPCO) study reported an annual incidence of complications of 0.7% for symptomatic people.<sup>10</sup>

In the UK and in North America, the number of surgical procedures for gallstone disease increased steadily between the 1950s and 1990s, reflecting both the rise in prevalence of gallstone disease and the use of cholecystectomy as the treatment of choice. Rates of surgical procedures stabilised in both countries towards the end of the twentieth century.

#### **1.1 Impact of health problem**

From a patient perspective, the defining symptom of gallstone disease is pain.<sup>11, 12</sup> Commonly, general abdominal symptoms intensify over a period of time and become regular pain attacks (biliary colic) and may require medical attention. Best medical therapy includes the prescription of analgesics and, when necessary, antibiotics.

The most common complications associated with gallstones are acute cholecystitis, common bile duct (CBD) stones and acute pancreatitis. CBD stones are found in up to 15% of people who undergo cholecystectomy. They may be asymptomatic or accompanied by biliary pain, jaundice, pancreatitis or cholangitis.<sup>13</sup> CBD stones can cause acute pancreatitis by obstructing the main pancreatic duct.<sup>14</sup>

Even though removal of the gallbladder is considered the standard treatment for symptomatic gallstones, it does not guarantee eradication of symptoms.<sup>15</sup> Up to approximately 40% of people may continue to experience pain and abdominal symptoms after surgery.<sup>16</sup> In particular, marked biliary pain has been described in 4-9% of people after cholecystectomy while persistent abdominal pain or non-specific pain persists in about 13%-37% of people.<sup>17-22</sup> A systematic review of the literature found that up to one-third of people suffered continuing pain after cholecystectomy and up to 14% of people experienced *de novo* pain.<sup>23</sup> Some investigators have also reported a persistent pain similar to that experienced pre-operatively in about 20% of people with gallstones. In a prospective study conducted in Denmark, 21% of people experienced the same type of pain after surgery.<sup>24</sup> Similarly, in a RCT conducted in the UK, 19% of people complained of biliary pain five years after open cholecystectomy.<sup>25</sup> No

difference has been observed between open and laparoscopic surgery in terms of persistent pain.

The term 'post-cholecystectomy syndrome' is an umbrella term which has been widely used to describe, though not accurately, the range of symptoms, which occur after cholecystectomy.<sup>26</sup> The term 'persistent post-cholecystectomy symptoms' has been suggested as a more accurate description of these symptoms.<sup>27</sup> These symptoms include: biliary and non-biliary abdominal pain, gastrointestinal disorders, dyspepsia, heartburn, nausea, vomiting, jaundice, and cholangitis. Severe symptoms that occur early after surgery may represent complications of cholecystectomy whilst those that manifest later (over months or years) are probably unrelated to cholecystectomy and can be explained by no biliary causes. Recent research has suggested that, in some people, functional gastrointestinal disorders and not gallstone disease may be the cause of persistent post-surgery symptoms.<sup>28</sup> Nevertheless, there is not a consistent pathophysiological explanation for persistent post-cholecystectomy symptoms and, in about 5% of people, the reason for persistent abdominal pain remains unknown.<sup>29</sup>

## 1.2 Rationale for the trial

At present cholecystectomy is the default option for people with symptomatic gallstone disease and one of the most common and costly surgical procedures performed in the NHS in the UK. Some 73,065 cholecystectomies were performed in England between 2012-2013 and 63,288 in 2014. Although some patients are operated in the acute hospital setting, many patients with uncomplicated symptomatic gallstone disease are put on a waiting list and operated on electively.

However, medical management may be a valid therapeutic option in people presenting with uncomplicated disease depending on their age, clinical presentation, and evolution of symptoms over time. Moreover, as these symptoms are usually not urgent, it may therefore be reasonable to take into consideration a non-surgical option first, which could save a considerable amount of NHS resources.

Recent studies stated that half of the people treated medically were symptoms free; therefore, up to 30,000 cholecystectomies per year could potentially be avoided with a potential saving for the NHS of £68 million annually. These resources could be freed (disinvestment) and allocated to fund alternative health care within the NHS.

Early natural history studies<sup>6</sup> and more recent observational and population-based studies have suggested that there is probably a proportion of people with symptomatic gallstone disease who no longer experience biliary pain after onset of symptoms. Larsen and colleagues<sup>5</sup> found that 45% of symptomatic people on watchful waiting were totally relieved from symptoms during a one-year observation period. Similarly, Festi and colleagues<sup>6</sup> observed that 58% of people with initially mild symptoms and 52% of those with more severe symptoms did not experience further episodes of pain during a follow-up period of 10 years and the severity of the disease did not increase over time.<sup>30, 31</sup> A recent NIHR Technology Assessment Report<sup>32</sup> found that on average cholecystectomy is more costly but more effective than medical management for the treatment of symptomatic gallstones or cholecystitis. Nevertheless, half of the people treated medically were symptom free and did not require surgery long term indicating that there is probably a proportion of patients with uncomplicated symptoms who could benefit from medical management. The specific results were that participants randomised to observation were significantly more likely to experience gallstone-related complication [risk ratio 6.69; 95% CI 1.57 to 28.51; p=0.01], in particular acute cholecystitis (risk ratio 9.55; 95% CI 1.25 to 73.27; p=0.03); but less likely to undergo surgery (risk ratio 0.50; 95% CI 0.34 to 0.73; p=0.0004), experience surgery-related complications (risk

ratio 0.36; 95% CI 0.16 to 0.81;  $p=0.01$ ) than those randomised to surgery. Fifty-five per cent of people randomised to observation did not require an operation during the 14-year follow-up period and 12% of people randomised to cholecystectomy did not undergo the scheduled operation. These results were subject to major uncertainties in the reported economic model. Even when cholecystectomy occurred, medical management had between 40% and 60% chance of being cost-effective for alternative values of willingness to pay for an additional QALY. Furthermore, results were heavily sensitive to the proportion of individuals originally followed with medical management that needed surgery. In their base case, the authors assumed that 44% of the cohort would need surgery within 5-years. If this proportion was reduced to 25% medical management became, on average, cost-effective. The report was based on the findings of the only two RCTs<sup>31, 33</sup> available in the literature and included only 201 participants in total. Both RCTs were conducted in Norway by the same research team. Due to the limited evidence available and the current lack of UK NHS data the investigators highlighted the need for a large, well-designed trial assessing the effects and safety of medical management compared with cholecystectomy.

## 2. AIMS AND OBJECTIVES

The **primary aim** of the study is to assess the clinical and cost effectiveness of medical management with cholecystectomy for preventing recurrent symptoms and complications in adults presenting with uncomplicated symptomatic gallstones in a secondary care setting.

The **primary patient objective** is to compare medical management with cholecystectomy in terms of participants' quality of life using the SF-36 short-form health survey bodily pain domain at up to 18 months after randomisation.

The **primary economic objective** is to assess the cost-effectiveness of medical management versus cholecystectomy in terms of the incremental cost per QALY.

The **secondary objectives** are to compare medical management with surgical treatment (cholecystectomy) in terms of condition specific quality of life; SF-36 domains (excluding bodily pain domain); complications; need for further treatment; persistent symptoms; health care resource use; costs. Secondary outcomes are at 18 and 24 months after randomisation. SF-36 short-form health survey bodily pain domain at up to 24 months after randomisation will also be reported.

The null hypothesis being tested is that there is no difference between medical management and cholecystectomy. The alternative hypothesis is that cholecystectomy is superior.

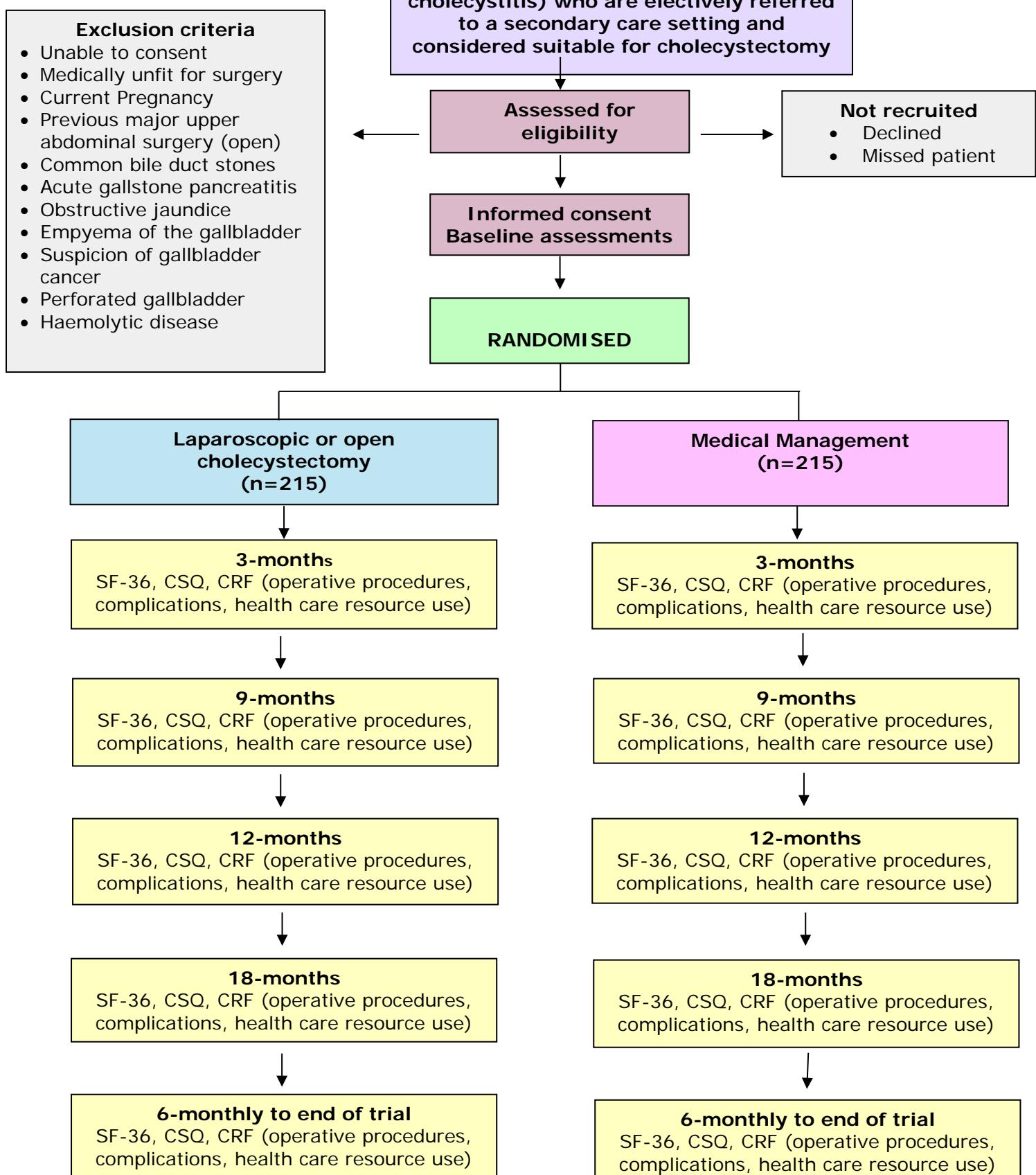
## 3. TRIAL DESIGN

A pragmatic, multi-centre parallel group patient randomised superiority trial (with internal pilot phase) to test if the strategy of standard cholecystectomy is more (cost-) effective than medical management at 18 months post randomisation. Other than the collection of outcome data, participant care will follow standard care pathways in participating NHS secondary care sites. A within trial economic evaluation will be conducted. Linear regression models will be used for this. Extrapolation beyond the trial follow-up period will be considered if a definite answer on cost-effectiveness cannot be reached from this within trial analysis.

The patient reported outcomes (SF-36; CSQ) will be assessed by participant-completed questionnaires at baseline, 3, 9, 12 and 18 months and 6 months thereafter, post randomisation, till end of trial. A case report form (CRF) will be completed at the time of surgery

providing details of the operative procedures, complications and resource use in hospital. Costs of the initial intervention procedures will be estimated from resource use data recorded on the case report forms coupled with routine unit cost data. Costs associated with subsequent contacts with primary and secondary care (due to symptomatic gallstones) will be estimated from patient questionnaires at 3, 9, 12- and 18-months and 6 months thereafter, post randomisation, till end of trial and checked at source. QALYs will be estimated from patients' responses to the SF-36. The trial flowchart is shown in Figure 1.

**Figure 1 Trial flowchart**



Embedded qualitative research will identify any challenges during the internal pilot related to design or conduct that can then be addressed and modified during progression to full trial. Fuller details are given in Appendix 1. Additionally, we are proposing to develop a core outcome set for uncomplicated symptomatic gallstones (see Appendix 2).

### **3.1 Interventions to be evaluated**

(i) Laparoscopic cholecystectomy: is the current standard surgical procedure for the management of symptomatic gallstone disease. The gall bladder is removed with the stones within it using keyhole techniques (laparoscopy). The procedure is undertaken under a general anaesthetic. It usually involves three to four small incisions in the abdomen, which allow the surgeon to dissect the gallbladder from its attachments and safely divide the key anatomical structures (the cystic duct and artery) that link it to the biliary tree. The gallbladder is then separated from the under surface of the liver. Usually the gallbladder (containing the stones) is removed within a retrieval bag via one of the small incisions. The operation takes between 45 and 120 minutes, many patients are admitted for one night, although day case laparoscopic cholecystectomy is safely undertaken in an otherwise fit patients with appropriate social support.

(ii) Medical management: Medical management in the context of gallstone disease involves the prescription of analgesics to relieve the biliary pain. Typical therapy includes paracetamol, nonsteroidal anti-inflammatory drugs NSAIDs (e.g. ibuprofen etc.), narcotic analgesics (e.g. opiates), antispasmodics (e.g. Buscopan), together with generic lifestyle advice.<sup>15, 34-37</sup> In the longer term, medical management also may involve these strategies for symptom management, if required, as well as advice to eat a healthy diet with regular meals (<http://www.nhs.uk/Conditions/Gallstones/Pages/Treatment.aspx>). For this trial a standard protocol for medical management will be agreed with the PPI group and used in all centres. Safety advice for patients in the medical management group will be aligned with the current advice given via the NHS choice website ([www.nhs.uk](http://www.nhs.uk)).

### **3.2 Trial population**

Adults with symptomatic uncomplicated gallstone disease (biliary pain) who are electively referred to a secondary care setting and considered suitable for cholecystectomy.

### **3.3 Setting**

Adult patients with diagnosed gallstone disease electively referred to a secondary care setting via GP referral, A&E department or elsewhere, not requiring emergency surgical or endoscopic intervention will be approached by the research teams.

### **3.4 Planned inclusion and exclusion criteria**

***Inclusion criteria:*** *Inclusion criteria:* All adult patients with confirmed symptomatic gallstones electively referred to a secondary care setting for consultation.

Clinical diagnosis of gallstone disease will be confirmed by imaging. Transabdominal ultrasonography is the standard imaging technique for the diagnosis of gallbladder stones, but diagnosis by any imaging technique is acceptable.

***Exclusion criteria:***

- Unable to consent
- Medically unfit for surgery
- Current pregnancy
- Previous open major upper abdominal surgery

- Gallstones in common bile duct or evidence of previous choledocholithiasis refers to gallstones in common bile duct on latest imaging or evidence of previous choledocholithiasis
- A history of acute pancreatitis
- Evidence of Obstructive jaundice
- Evidence of empyema of the gallbladder with sepsis
- Suspicion of gallbladder cancer
- Perforated gallbladder (refers to recent or old perforation detected on imaging).
- Haemolytic disease

### **3.5 Recruitment and Trial Procedures**

#### **3.5.1 Identifying participants**

General practitioners within the study area have an important role in awareness raising among those potential recruits to the study that they are referring or admitting to hospital. We will provide information about the study to all referring GPs within the study areas, if and as required. In Scotland we will contact and attend the relevant health board's GP subcommittees. Subsequently we will work with the board's primary care directorate to cascade information to individual GP practices and registered locums. In England we will contact the relevant Clinical Research Network primary care leads and seek permission to contact referring GPs within their grouping. Additionally, in the regions where the study is taking place we will liaise with the relevant Clinical Commissioning Groups as a further means of cascading information to relevant GPs. We will provide GPs with standardised information about the study and make the protocol available to them. We will encourage GPs to make patients aware of the study and why it is being conducted when they refer or admit potential recruits to the study. Participants will be identified by the local research team at participating centres. Local procedures at the participating hospitals are different and the timing and mode of approach to patients and the consent process may vary in order to accommodate both the specific circumstances at each site and the needs of the patients.

Following identification of potential participants, an invitation letter and patient information leaflet (PIL) detailing the trial will be sent out, inviting them to attend an outpatient clinic visit where the trial and their treatment will be discussed. Potential participants not identified prior to a clinic visit or at sites that are unable to send the PIL in advance, will be given the PIL at the outpatient clinic visit. The PIL will also highlight that the clinical consultation may be audio-recorded, in sites who have agreed to do this, and that participants will be asked for consent to do so. At the clinic consultation, the research team will outline the trial and ask the patient if they are willing to discuss participation and have their conversation audio-recorded. For those patients who are happy with this proposal the process will follow as described. A member of the local research team will complete a trial screening form using information from the prospective participant and from the clinical record to document fulfilment of the entry criteria. Eligibility criteria will be cross-checked with the clinical record. If the patient is eligible and in provisional agreement, a local research team member will meet with the patient immediately in the clinic. Eligible participants who express interest in participating will have the study explained to them by local research staff and asked if they have any questions or concerns about participating in the trial. If they agree to take part they will give written consent to be randomised. Standard local arrangements concerning pre-assessment, admission, consent for surgery, conduct of surgery and after care will continue unimpaired.

The PIL and consent form refer to the possibility of long term follow up to determine the incidence of future operations. The PIL and consent form also refer to the possibility of participants being contacted in the future to participate in other relevant research. Eligible and

randomised participants as well as who are not willing to consider randomisation may be contacted to participate in a semi-structured audio recorded interview (See Appendix 1 for details of Qualitative Research).

The patient information leaflet provides clear details of the anticipated risks and benefits of trial participation. Risks associated with both treatment arms are explicitly mentioned. The risk and benefits of the study will also be discussed by the local research nurses and the patient's own Consultant as part of the process of obtaining informed consent.

### **3.5.2 Informed consent**

Informed consent to participate in the trial will be sought and obtained according to Good Clinical Practice (GCP) guidelines. Informed signed consent forms will be obtained from the participants in all centres, by an appropriately trained individual. Participants will be given sufficient time to accept or decline involvement and will be free to come out of the study at any time. Patients may make a decision to participate during an initial consultation, during a subsequent visit to hospital, or alternatively at home. If the patient agrees to be contacted at home, he/she may receive a telephone call from the local Research Nurse to discuss any queries. Patients who decide to participate following telephone counselling can either send their completed documents (consent form and baseline questionnaire) through the post to the local team at their treating hospital or bring it with them if they are returning to hospital for another consultation.

A significant qualitative component is proposed for this study to underpin its development and to inform how best to interpret the results of the trial. The qualitative component is entirely optional, but consent will be sought to audio record the initial consultation when the trial is discussed and for interviews with both those who consent and refuse randomisation.

Participants who cannot give informed consent (e.g. due to their mental state) are not eligible for either the randomised trial or the qualitative work.

### **3.5.3 Randomisation and allocation**

Eligible and consenting participants will be randomised to one of the two intervention groups using the proven 24-hour telephone Interactive Voice Response randomisation application or via the web-based application, both hosted by CHaRT. The randomisation algorithm will use recruitment site, gender (male/female) and age (<35; 35-64; ≥65) as minimisation covariates to allocate treatment to intervention and control groups in a 1:1 ratio. A random element will be incorporated into the randomisation algorithm. The PI at site, or individual with delegated authority, will access the telephone or web-based system. Patient screening identification, initials and recruiting site (the stratifying variable) will be entered into the voice-activated or web-based system, which will return the allocation status. After obtaining patient consent, randomisation will happen in the clinic and participants will be informed of their allocated treatment group following randomisation. If the participants are not present in the clinic, they will be contacted by the research teams to inform them of the allocated treatment group after randomisation.

### **3.5.5 Follow-up procedures**

The patient reported outcomes (SF-36; CSQ) will be assessed by participant-completed questionnaires at baseline, 3, 9, 12- and 18-months and 6 months thereafter, post randomisation, till end of trial. If the trial questionnaire is not completed, a postal reminder will be sent. If there is no response to the postal reminder, a telephone call will be made to the participant to try and capture outcome data. If this call is unsuccessful a further postal reminder will be sent. A case report form (CRF) at the time of any gallstone surgery will be collected providing details of the operative procedures, complications and resource use in hospital. Costs of the initial intervention procedures will be estimated from resource use data

recorded on the case report forms coupled with routine unit cost data. Costs associated with subsequent contacts with primary and secondary care (due to symptomatic gallstones) will be estimated from patient questionnaires at 3, 9, 12- and 18-months and 6 months thereafter, post randomisation, till end of trial, and checked at source. QALYs will be estimated from patients' responses to the SF-36.

### **3.5.6 Change of Status/Withdrawal procedures**

Participants will remain in the trial unless they choose to withdraw consent or if they are unable to continue for a clinical reason. All changes in status with the exception of complete withdrawal of consent will mean the participant is still followed up for all trial outcomes wherever possible. All data collected up to the point of complete withdrawal will be retained and used in the analysis.

### **3.5.7 Subsequent arrangements**

#### **Informing key people**

Following formal trial entry:

The Study Office will:

- i) inform the participant's General Practitioner (GP) (by letter) enclosing information about C-Gall and the Study Office contact details.

The local Research Nurse/Recruitment Officer and/or PI will:

- i) file the Hospital Copy of the Consent form in the hospital notes along with information about C-Gall.
- ii) inform the ward and theatre staff as appropriate of the participant's entry to the trial and details of the intervention allocation (theatre only).
- iii) use the C-Gall internet database to enter data regarding the participant, including data required to complete randomisation; and intra-operative and postoperative information abstracted from local medical records.
- iv) maintain and archive Study documentation at the site. A copy of the signed consent form is returned to the Study Office in Aberdeen after database entry.
- v) provide any relevant follow-up clinical data.

#### **Monitoring the participants**

Participants will be contacted by phone, post or email as appropriate. Participants will be asked to contact the study office when they are given an appointment for their surgery. In case of non-return of questionnaires, or non-attendance at outpatient appointments, attempts will be made by staff at the Study Office to trace the participant directly using these means or indirectly by contacting the GP.

#### **Notification by GPs**

GPs are asked to contact the Study Office if the participant moves, becomes too ill to continue or dies, or any other notifiable or adverse event occurs. Alternatively, staff at the Study Office may contact the GP.

#### **Offices for National Statistics (NHS Digital data in England, ISD [Information Statistics Division] data in Scotland)**

Consent will be sought from all participants to trace their medical records and addresses from local records and centrally held computerised databases. This should facilitate long term follow up.

## 4. SAFETY

The C-Gall trial involves two different procedures for treating gallstones, surgical management and medical management. Surgical management (laparoscopic cholecystectomy) is well established in current NHS clinical practice. Medical management involves treating symptoms of gallstone disease with analgesia, dietary and life style advice. Adverse events may occur during or after any type of surgery. We will monitor adverse events.

Adverse events that meet the criteria for 'serious' will be reviewed in order to determine whether or not the event was 'related'. Within C-Gall, 'related' is defined as an event that occurs as a result of a procedure required by the protocol, whether or not it is either a) the specific intervention allocated at randomisation or b) it is administered as an additional intervention as part of normal care.

All serious adverse events that are considered to be 'related' will be recorded on an SAE form.

Serious adverse events that are not related will not be recorded.

All deaths will be recorded on an SAE form.

### 4.1.1 Definitions

An **adverse event** (AE) is any untoward medical event affecting a clinical trial participant. Each AE will be considered for severity, causality and expectedness and may be reclassified as a serious event based on prevailing circumstances.

Adverse events are not:

- Continuous and persistent disease or symptoms present before the trial, which fail to progress;
- Signs or symptoms of the disease being studied (in this case gallstones); or
- Treatment failure

A **serious adverse event** (SAE) is any AE that:

- results in death;
- is life threatening (i.e. the subject was at risk of death at the time of the event; it does not refer to an event which hypothetically might have caused death if it were more severe);
- requires hospitalisation or prolongation of existing hospitalisation;
- results in persistent or significant disability or incapacity;
- is a congenital anomaly or birth defect,
- is otherwise considered medically significant by the investigator

#### **4.1.2 C-Gall specific expected adverse events:**

In this trial the following events are potentially expected.

*Adverse events during or after laparoscopic cholecystectomy.*

#### **Intraoperative complications.**

- Bleeding > 500 ml
- Injury to abdominal viscera, including liver tear or laceration
- Anaesthetic complications (including hypersensitivity to the general anaesthesia and /or any of the medications or material used)
- Injury to the bile duct
- Bile leak from the bile duct, hepatic duct or ducts at the base of the liver or bile spillage from the gallbladder
- Bile/ stone spillage from the gallbladder

#### **Immediate post-operative complications.**

- Post-operative bleeding > 500ml
- Injury to the abdominal viscera, Including liver tear or laceration
- Injury to bile duct
- Bowel obstruction
- Wound Infection
- Pain. Requiring additional analgesia
- Bile leak
- Thrombosis (Deep vein thrombosis/ Pulmonary embolism)
- Urinary retention
- Infection (sepsis, septicaemia, abscess)
- Retained/ missed common bile duct stone

#### **Late post-operative complications.**

- Incisional / port site hernia
- Chronic wound pain
- Infection (sepsis, septicaemia, abscess)
- Biliary pain
- Non-specific abdominal pain
- Post cholecystectomy jaundice

#### **Potential adverse event during medical management/ pre-surgery.**

There may be a 0.7%/year risk of developing a potential adverse event in the medical management group that might require further surgery or endoscopic treatment. The following are expected.

- Acute cholecystitis
- Empyema/mucocele
- Gallbladder perforation

- Acute pancreatitis
- Common bile duct stone
- Obstructive jaundice
- Gallstone ileus

## 4.2 Procedures for detecting, recording, evaluating & reporting AEs, SAEs

### 4.2.1 Detecting AEs and SAEs

Non-serious adverse events will be recorded in the case report forms (CRFs). Planned primary care or hospital visits for conditions other than those associated with symptomatic uncomplicated gallstone disease will not be recorded.

Adverse events that meet the criteria for 'serious' will be reviewed in order to determine whether or not the event was 'related'. (Within C-Gall, 'related' is defined as an event that occurs as a result of a procedure required by the protocol, whether or not it is either a) the specific intervention allocated at randomisation or b) it is administered as an additional intervention as part of normal care).

All related SAEs should be recorded from the time a participant consents to join the trial until the end of their follow-up.

All serious adverse events that are considered to be 'related' will be recorded on an SAE form. Only those that are unexpected will be reported in an expedited fashion to sponsor and REC.

### 4.2.2 Evaluating AEs and SAEs

#### ***Assessment of Seriousness***

The Investigator should make an assessment of seriousness as defined in Section 4.1.1.

#### ***Assessment of Relatedness (Causality)***

The Investigator must make an assessment of whether the AE/SAE is likely to be related to treatment according to the following definitions:

- **Related:** An event that occurs as a result of a procedure required by the protocol, whether or not it is either a) the specific intervention allocated at randomisation or b) it is administered as an additional intervention as part of normal care.
- **Unrelated:** where an event is not considered to be the result of a procedure required by the protocol.

Alternative causes such as natural history of the underlying disease, concomitant therapy, other risk factors and the temporal relationship of the event to the treatment should be considered.

#### ***Assessment of Expectedness***

When assessing expectedness refer to the previous list of expected events (Section 4.1.2).

#### **4.2.3 Recording AEs and SAEs**

SAEs that are related require an SAE form to be completed. This can be recorded directly onto the study website within 24 hours of becoming aware of the event. All deaths will be recorded on an SAE form.

#### **4.2.4 Reporting SAEs**

##### *Reporting responsibilities of the CI*

When an SAE form is uploaded onto the trial website, the Trial Manager will be automatically notified. If, in the opinion of the local PI and the CI, the event is confirmed as being *serious* and *related* and *unexpected*, the CI or Trial Manager will notify the sponsor within 24 hours of receiving the completed SAE notification. The sponsor will provide an assessment of the SAE. A Sponsor cannot downgrade an assessment from the PI or CI. Any disparity will be resolved by further discussion between these parties.

The CI or delegate will report any related and unexpected SAEs to the REC within 15 days of the CI becoming aware of it. All related SAEs will be summarised and reported to the REC, the Funder, the Trial Steering Committee and the Data Monitoring Committee in their regular progress reports.

If all the required information is not available at the time of reporting, the Investigator must ensure that any missing information is provided as soon as this becomes available. It should be indicated on the report that this information is follow-up information of a previously reported event.

### **5. OUTCOME MEASURES**

#### **5.1 Primary outcome measure**

The *primary patient outcome measure* will be quality of life as measured by area under the curve (AUC) at up to 18 months post-randomisation using the SF-36 bodily pain domain (AUC measures at 3, 9, 12 and 18 months).

The *primary economic outcome measure* will be incremental cost per QALY.

#### **5.2 Secondary outcome measures**

The secondary outcomes measures will include:

Condition specific quality of life; SF-36 domains (excluding bodily pain domain); complications; need for further treatment; persistent symptoms; health care resource use; costs will be reported at months post-randomisation. The AUC at up to 24 months post-randomisation for the SF-36 bodily pain domain will be reported.

In addition, routinely collected national data on further surgery will be sought in the future to update longer term estimates of cost-effectiveness.

## 6. DATA COLLECTION AND PROCESSING

### 6.1 Measuring outcomes

The Patient Reported Outcome Measurement Group at the University of Oxford published recommendations to the Department of Health on the appropriate patient reported outcomes to consider for patients undergoing cholecystectomy.<sup>38</sup> The report concludes that the SF-36 has good evidence in assessing general quality of life in patients undergoing cholecystectomy in the UK. In addition, the report states that “the Otago Gallstones Condition-Specific Questionnaire is worthy of consideration above the other condition-specific measures.” We are using both in this study. The Otago gallstones condition-specific questionnaire (CSQ)<sup>39</sup> devised a conceptual model for gallstone-specific quality of life, with four underlying domains: Physical Functioning (pain, dyspepsia and diet changes), Systemic Functioning (fatigue), Social Functioning (daily duties, leisure, relationships) and Emotional Functioning (mood). The CSQ contains 12 items, each with a 5-point Likert response scale. The CSQ is succinct, has high patient acceptance and can be used in conjunction with the generic SF-36.<sup>39</sup>

The patient reported outcomes (SF-36; CSQ) will be assessed by participant-completed questionnaires at baseline, 3, 9, 12- and 18-months and 6 months thereafter, post randomisation, till end of trial. The research nurse will complete a case report form (CRF) at the time of surgery providing details of the operative procedures, complications and resource use in hospital. Costs of the initial intervention procedures will be estimated from resource use data recorded on the case report forms coupled with routine unit cost data. Costs associated with subsequent contacts with primary and secondary care (due to symptomatic gallstones) will be estimated from patient questionnaires at 3, 9, 12- and 18-months and 6 months thereafter, post randomisation, till end of trial. QALYs will be estimated from patients' responses to the SF-36 at 3, 9, 12- and 18-months and 6 months thereafter, post randomisation, till end of trial. The components and timing of follow-up measures are shown in Section 6.2.

### 6.2 Schedule of data collection

	Baseline	Surgery*	3 months	9 months	12 months	18 months	6 monthly thereafter
<b>SF-36</b>	X		X	X	X	X	X
<b>CSQ</b>	X		X	X	X	X	X
<b>CRF</b>	X	X	X	X	X	X	X
<b>Resources use questionnaire</b>			X	X	X	X	X
<b>Time and travel questionnaire</b>						X	

\*Surgery CRF completed where appropriate.

### 6.3 Data processing

Research nurses will enter locally collected data in the centres. Staff in the Trial office will work closely with local Research Nurses to ensure the data are as complete and accurate as possible. Follow-up questionnaires to participants will be sent from and returned to the Trial Office in Aberdeen. Extensive range and consistency checks will further enhance the quality of the data.

## 7. SAMPLE SIZE, PROPOSED RECRUITMENT RATE AND MILESTONES

### 7.1 Sample size

Any pain attacks will likely be intermittent and of relatively short duration, so an outcome measure at a single point in time is unlikely to be sensitive enough to detect real differences. A more comprehensive outcome would incorporate the total quality of life of the participant throughout the study. Therefore, the primary outcome is the area under the curve (AUC) of the SF-36 bodily pain domain up to 18 months post randomisation. In order to detect a 0.33 SD difference, 90% power with alpha 5%, 194 participants per group (388 total) are required. Such a difference in generic health status is considered clinically relevant and in terms of treatment effect size, in the small to medium range as observed in other clinical studies. To allow for the anticipated approximately 10% of participants for whom outcome data are completely missing, and therefore the AUC cannot be calculated, it is proposed to randomise 430 participants.

The current evidence suggests that around 44% of patients will not receive surgery with a medical management policy at 5 years follow-up (11% per year).<sup>32</sup> The economic modelling also suggests that if around 25% or less of the medical management group receives surgery by 5 years, the medical management strategy becomes cost effective. This would equate to approximately 5% per year. We have therefore also considered how precisely the proportion of medically managed patients going on to have surgery can be estimated in the study when considering the sample size. A trial with 200 medically managed patients estimates this proportion to within 5% with 95% statistical confidence. If the current best evidence of 10% at 12 months post-surgery is realised, we would be able to rule out a 5% rate or less.

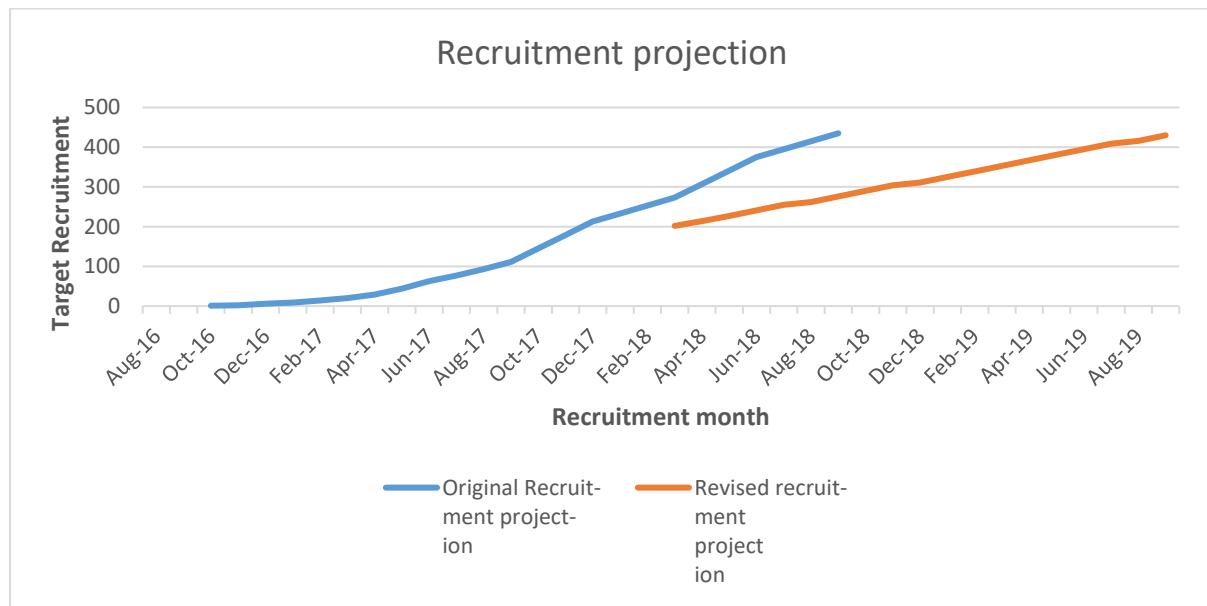
### 7.2 Recruitment rates and Milestones

Most recent NHS Digital Statistics suggest that around 70,000 people have surgical treatment for gallstones each year in England. The trial centres conduct an average of 500 cholecystectomies per year. Based upon surgeon estimates, at least 10-20% (50-100) of the patients would be symptomatic, uncomplicated disease. We propose a 36-month recruitment period (months 7-42 inclusive) based on a conservative throughput of 50 eligible patients per year in 20 centres with the assumption that 50% of eligible patients in the first month and 50% in August and December will be missed. We expect that 40% of the remaining eligible patients will be willing to be randomised. The projection detailed below allows for a staggered study site set-up with all centres active by the end of month 24.

### 7.3 Recruitment projection

The recruitment projection was based on approximately 20 active centres participating across a 24 months recruitment period with the expectation that they will contribute an estimate of 2 participants per month per site in steady state. Recruitment at all sites was reduced in the first month and in the peak holiday months of July/August and December. The first 20 patients were expected to be recruited by Month 12, 111 patients by Month 18 and the remaining 319 patients by Month 30 making a total of 430 patients. Due to slower than anticipated recruitment, projections were revised from month 24 to month 42 giving a total of 36-month recruitment period. The projected recruitment is modelled below in Figure 1. Note first six months (months 1 to 6) of project, no recruitment is expected and is not included in Figure 2.

Figure 2 Recruitment projection



#### 7.4 Internal pilot study

The internal pilot was primarily designed to verify that recruitment was possible. There were three areas of uncertainty that we proposed to verify during the internal pilot study. These areas were (i) the generalisability of the randomised participants (ii) the willingness to randomise and (iii) ability to scale-up the number of centres. To address these areas, we initially set-up four selected pilot centres in the first 12 months of the study. Within these four centres, detailed clinical screening logs were implemented. The screening logs recorded the number of screened participants, the number ineligible and number eligible. The four centres also took part in embedded qualitative research to help the trial team understand barriers and facilitators to recruitment during this phase (see Appendix 1). From months 12 to 24, the internal pilot continued with the scaling-up of the trial to the rest of the trial centres.

#### 7.5 Stop/go criteria

During the internal pilot phase, we proposed two decision points - one at month 12 and another at month 18. By month 12, 14 centre months of recruitment should have occurred, and 20 participants randomised across the four centres. By end month 18, 94 centre months of recruitment should have occurred, and 111 participants randomised across 20 centres. After the internal pilot, we also proposed an early check of the AUC assumption, average recruitment rate and rate of crossovers during follow-up. The proposed stop/go criteria were:

##### At 12 months

- recruited projected participants (currently 20)
- recruited at least 20% of eligible patients

##### At 18 months

- Recruited the appropriate number of centres to achieve recruitment target (currently 20)
- The average recruitment rate per site per month is at least one

At 24 months

- The AUC estimate is no more than 10% larger than current estimate of 0.33
- The crossover rate is greater than 50%

Full details of the stop-go criteria for the progression to the main trial will be developed in a detailed progression plan in the Statistical Analysis Plan, in consultation with the HTA Board.

A green/amber/red approach to progression at 12 and 18 months has been included in the trial:

- Green: 100% of target recruitment achieved (20 at 12 months and 111 at 18 months and centres recruiting average of at least 1 participant per month) - automatic progression.
- Amber: 50-100% recruitment achieved (10-20 at 12 months or 55-111 at 18 months or centres recruiting average between 0.5 and 1 participant per month at 18 months) - identify remediable factors and submit recovery plan to HTA with new targets for the following 6 months.
- Red: less than 50% recruitment achieved (<10 at 12 months or <55 at 18 months or centres recruiting average of less than 0.5 participants per month)- stop the trial unless there is a strong case that unanticipated remediable factors have been identified and can be addressed.

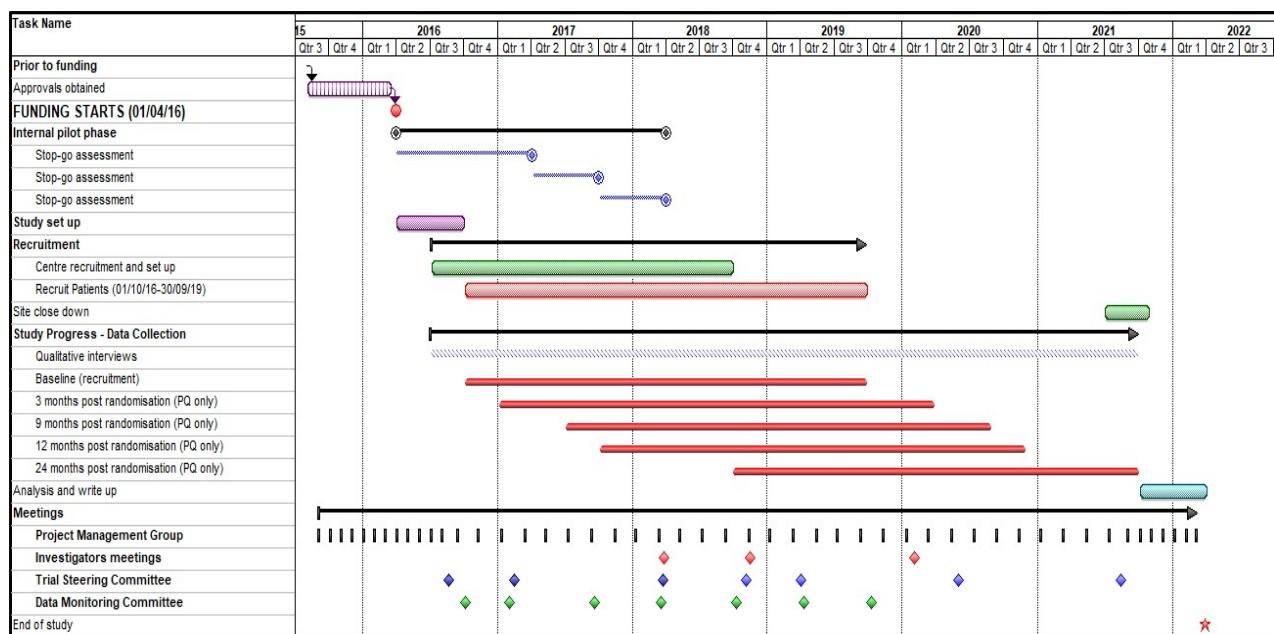
All stop-go criteria fulfilled.

#### ***Project timetable and milestones***

The projected start date for the study is 1 April 2016: the study duration will be 72 months. Milestones are:

Pre-funding: multicentre research ethics and central R&D approvals; Month 1-6: Study set-up authorisations; Months 7-42: patient recruitment; Months 7-66 core outcome set, and qualitative findings completed. Months 31-66 patient follow up at 24 months; Months 67-72 analysis of data, interpretation of results and report writing. The Gantt chart is shown below in Figure 3.

**Figure 3: Gantt Chart**



## 8. STATISTICAL ANALYSIS

The primary outcome, area under the curve (AUC) for the SF-36, will be generated for each participant using Trapezium's rule. Score data for participants who have missed a scheduled questionnaire will be estimated using a multiple imputation approach to make use of partial outcome data. Sensitivity analyses will be conducted to assess the robustness of the treatment effect estimate to these approaches. Missing items on the health-related outcome measures will be treated as per the instructions for that particular measure. The primary outcome measure will be analysed using linear regression with adjustment for the minimisation variables (site of recruitment, gender and age). Secondary outcomes will be analysed using generalised linear models with adjustment for minimisation and baseline variables as appropriate. Statistical significance will be at the 2-sided 5% level with corresponding confidence intervals derived. Subgroup analyses will explore the possible modification of treatment effect by clinically important factors; gender and age. This will be done by including treatment-by-factor interactions in the model and they will be classified as exploratory analyses. All analyses will initially be performed on an intention to treat basis, although we will consider additional analysis groups such as per-protocol. The main statistical analyses will be based on all participants as randomised, irrespective of subsequent compliance with the treatment allocation. From the internal pilot phase we will report estimates of recruitment rates and potential participant availability, together with appropriate confidence intervals. There are no planned interim outcome analyses; all analyses will occur following completion of trial follow up. Interim analyses will be performed if requested by the Data Monitoring and Ethics Committee (DMC).

## 9. ECONOMIC EVALUATION

This study will include an economic evaluation of cholecystectomy against medical management to assess the relative efficiency of these care pathways. A within trial cost-utility analysis will be conducted. The need to extrapolate beyond the study follow-up period will be considered if a definite answer on cost-effectiveness cannot be obtained from the within trial analysis.

Brazzelli et al<sup>32</sup> identified a number of uncertainties in their modelling based economic evaluation. Particularly, there was uncertainty in the resources used by, as well as the quality of life of, individuals that followed a medical management strategy. In addition, there was uncertainty in the proportion of individuals having surgery after being allocated to a medical management care pathway. Cholecystectomy was, on average, cost effective for their base case analysis. However, the mentioned uncertainties in the economic evaluation model resulted in a 50% probability of cholecystectomy being cost-effective at a £30,000 willingness to pay for a QALY threshold<sup>32</sup> (the usual threshold used for decision making in the UK<sup>40</sup>) This study will inform these uncertainties and aim to provide a more precise answer to this decision problem.

#### *The economic analysis*

The economic analysis will rely on participant responses to the SF-36 to estimate quality adjusted life years (QALYs) at 24 months. Resource use and costs will be estimated for each participant. The evaluation will consider the costs of the care pathways that patients follow; i.e. the costs of the surgery (e.g. cholecystectomy) as well as the cost of simultaneous and subsequent use of primary and secondary NHS services (including additional interventions received) by participants. Personal costs such as purchase of medications, particularly analgesics, will be estimated. The clinical condition affects adult individuals that might still be in their working age; therefore, time off work will be also retrieved to estimate indirect costs (e.g. human capital approach). The incorporation of indirect costs into the economic evaluation is debatable; however, the collection of these data will open the possibility to include these costs into the analysis or report them separately following reporting practice at the time of analysis.

#### *Collection and valuation of data*

Hospital inpatient and outpatient resource use data (e.g. hospital admissions by type of service; outpatient visits, etc.) will be retrieved from participants' hospital case notes. In addition, primary care resource use (e.g. GP visits) time off work, out of pocket purchases of medications and quality of life data (e.g. SF-36) will be obtained from patient questionnaires at 3, 9, 12, 18 and 24 months. The analysis will be conducted from the UK NHS and personal social services perspective. Therefore, resource used will be valued using appropriate unit prices obtained from national sources, including the NHS reference costs,<sup>41</sup> the Unit cost of health and social care.<sup>42</sup> British National Formulary<sup>43</sup> will be used to obtain unit costs to value medications and wage categories to value time off work. Preference based measures of health related quality of life can be obtained from the responses to the SF-36 questionnaire using parametric<sup>44-46</sup> or non-parametric techniques.<sup>47</sup> This is an evolving area of research; hence, the most up to date techniques at the time of analysis will be used. The utility scores used to value the SF-36 health states were obtained using standard gamble techniques with a representative sample for the UK population. These utility scores will be used to calculate quality adjusted life years (e.g. the area under the curve) for each trial participant.

#### *Assessment of cost-effectiveness*

Cost-effectiveness will be measured in terms of costs of the care pathways and quality adjusted life years (QALYs) at 24 months post randomisation for the within trial analysis. Mean NHS costs, patient costs and QALYs will be compared between randomised groups at 18 months. Incremental costs and QALYs will be estimated for cholecystectomy versus medical management using linear regression with adjustment for minimisation variables and baseline variables (e.g. baseline utility scores) as appropriate. Final decision on what regression model to use is data dependent. However, methodological guidelines will be used to define the best approach at the time of analysis.<sup>48</sup> Uncertainty surrounding joint estimates of incremental cost and effects will be characterised and presented graphically using cost-effectiveness acceptability curves.<sup>49, 50</sup> Guidelines for economic evaluation advocate for a long enough time

horizon to consider all cost and consequences relevant for the analysis.<sup>40</sup> However, a definite answer on cost-effectiveness could be obtained from the analysis at 24 months follow-up. This would be the case, for instance, if very small or very high number of individuals in the medical management group actually receives surgery. Consequently, a final decision on extrapolating the analysis beyond the clinical trial follow-up will be done depending upon the within trial analysis result. The extrapolation analysis might involve the development of a simple state transition model (e.g. Markov model).

## **10. ORGANISATION: TRIAL MANAGEMENT AND OVERSIGHT ARRANGEMENTS**

### **10.1 Trial office in Aberdeen**

The Trial Office is in the Centre for Healthcare Randomised Trials (CHaRT) based within the Health Services Research Unit, University of Aberdeen and provides day to day support for the clinical centres. The Trial Manager in CHaRT at Aberdeen will take responsibility for the day to day transaction of trial activities. The Data co-ordinator will provide clerical support to the trial, including organising all aspects of the postal questionnaires (mailing, tracking, and entering returned data using the trial web data entry portal).

The C-Gall Trial Office Team will meet formally at least monthly during the course of the trial to ensure smooth running and trouble-shooting. Finally, we intend to produce a yearly C-Gall Newsletter for participants and collaborators to inform everyone of progress and maintain enthusiasm.

Any modification to the project shall be approved by the Sponsors and funder before application to REC and R&D unless in the case of immediate safety measures when the Sponsor shall be notified as soon as possible.

### **10.2 Local organisation in sites**

The Local PI and research nurse will be responsible for all aspects of local organisation including identifying, consenting, and randomising the participants, along with facilitating the delivery of the intervention and notification of any problem or unexpected developments for the duration of the trial. The research nurse will be responsible for ensuring that study data are collected for baseline assessments, collecting and recording participant study data on study specific Case Report Forms, provide any relevant follow-up clinical data, and will log details onto the remote web-based data capture system in a timely manner.

### **10.3 Project Management Group (PMG)**

The trial is supervised by its Project management Group (PMG). This consists of the grant holders and representatives from the Trial Office. Observers may be invited to attend at the discretion of the PMG. We will meet/teleconference every two months on average.

The research team has the expertise to cover the clinical and surgical aspects of the research

### **10.4 Trial Steering Committee (TSC)**

The trial is overseen by a Trial Steering Committee (TSC). The membership of this Committee is comprised of four independent members along with the Chief Investigator (Ahmed/Ramsay) or a nominated delegate. The trial sponsor(s) other grant-holders and key members of the central office (e.g. the trial manager) can participate in TSC meetings but are not members. The funders will be notified in advance of meetings and a representative invited to attend. Other relevant experts may be invited to attend as appropriate. Details of the membership of the TSC can be found at the start of this

protocol. CHaRT has adopted the TSC Charter adapted from the DAMOCLES Charter for DMCs and suggests to the independent TSC members that they adopt the Terms of Reference contained within. The TSC will meet approximately yearly. A copy of the TSC minutes will be forwarded to the sponsor.

### **10.5 Data Monitoring Committee (DMC)**

The independent Data Monitoring Committee (DMC) is made up of members listed at the start of this protocol, one of whom is an experienced statistician. After the trial has been initiated the DMC will initially meet to agree its terms of reference and other procedures. CHaRT has adopted the DAMOCLES Charter for DMCs and suggests to the independent DMC members that they adopt the Terms of reference contained within.

The Committee will meet regularly (at least yearly) to monitor the unblinded trial data and serious adverse events and make recommendations as to any modifications that are required to be made to the protocol or the termination of all or part of the trial.

## **11. RESEARCH GOVERNANCE, DATA PROTECTION AND SPONSORSHIP**

### **11.1 Research Governance**

The trial will be run under the auspices of CHaRT based at HSRU, University of Aberdeen. This will aid compliance with Research Governance, and provide centralised trial administration, database support and economic and statistical analyses. CHaRT is a registered Clinical Trials Unit with particular expertise in running multicentre RCTs of complex and surgical interventions.

The CI will ensure, through the TSC, that adequate systems are in place for monitoring the quality of the trial (compliance with appropriate governance) and appropriate expedited and routine reports, to a level appropriate to the risk assessment of the trial. The Sponsors Standard Operating Procedures shall be followed.

### **11.2 Data protection**

Data collected during the course of the research will be kept strictly confidential and accessed only by members of the trial team. Participant's details will be stored on a secure database in accordance with the General Data Protection Regulation (GDPR) and the Data Protection Act 2018, and regular checks and monitoring are in place to ensure compliance. The senior IT Development manager (in collaboration with the Chief Investigator) will manage access rights to the data set. Participants will be allocated an individual specific trial number and their details will be anonymised on the secure database. We anticipate that anonymised trial data may be shared with other researchers to enable international prospective meta-analyses. To comply with the GDPR principle on storage limitation, personal data will not be kept for longer than is necessary for the purposes for which the personal data are processed.

### **11.3 Sponsorship**

The University of Aberdeen and Grampian Health Board (NHS Grampian) are the co-sponsors for the trial.

## **12. ETHICS AND REGULATORY APPROVALS**

The North of Scotland Research Ethics Committee (2) has reviewed this trial. The trial will be conducted according to the principles of good clinical practice provided by Research Governance Guidelines. Annual progress reports and a final report at the conclusion of the trial will be submitted to North of Scotland REC within the timelines defined in the

regulations. A copy of the Annual progress report and the final report shall be forwarded to the Sponsors.

### **13. QUALITY ASSURANCE**

The trial will be monitored to ensure that the trial is being conducted as per protocol, adhering to Research Governance, and the appropriate regulations. The approach to, and extent of, monitoring (specifying both central and on-site monitoring) will be specified in a trial monitoring plan which is usually initially determined by a risk assessment, undertaken prior to start of trial. Investigators and their host Trusts will be required to permit trial related monitoring and audits to take place by Sponsors and/ or regulatory representatives providing direct access to source data and documents as requested.

#### **13.1 Risk assessment**

An independent risk assessment has been carried out by the sponsor. The trial will be monitored to ensure that the study is being conducted as per protocol, adhering to Research Governance, and the appropriate regulations. The approach to, and extent of, monitoring is specified in the trial monitoring plan and is appropriate to the risk assessment of the study.

### **14. FINANCE AND INSURANCE**

The trial is funded by a grant awarded by the NIHR Health Technology Assessment programme.

The necessary trial insurance is provided by the University of Aberdeen.

### **15. END OF TRIAL**

The end of follow-up for each participant is defined as the final data capture to answer the research question. The end of the trial is defined as the end of funding.

The end of the trial will be reported to the REC within 90 days, or 15 days if the trial is terminated prematurely. The end of the trial will be reported to the Sponsors within 90 days. The Investigators will inform participants and ensure that the appropriate follow up is arranged for all involved.

A summary report of the trial will be provided to the Sponsors as well as the REC within one year of the end of the trial. An end of trial report will also be issued to the funders at the end of funding.

### **16. DATA HANDLING, RECORD KEEPING AND ARCHIVING**

Clinical data will be entered into the database by the local investigator and/or research nurse working in each hospital site, together with data from questionnaires completed at clinic. Questionnaires returned by post to the trial office will be entered there. Staff in the trial office will work closely with local research nurses to ensure that the data are as complete and accurate as possible. Extensive range and consistency checks will further enhance the quality of the data.

The co-sponsors are responsible for ensuring that trial data are archived appropriately in accordance the GDPR and Data Protection Act 2018. All essential data and documents (electronic, hard copy and audio recordings) shall be retained for a period of at least 10 years after close of trial according to the relevant UoA/NHSG Sponsor and CHaRT archiving SOPs. The archiving procedures for local sites will be performed as documented in the Sponsor site agreement.

## **17. SATELLITE STUDIES**

It is recognised, that the value of the trial may be enhanced by smaller ancillary studies of specific aspects. Plans for these will be discussed in advanced with the Project Management Group. REC approval will be sought for any new proposal, if appropriate. Sponsorship will be sought for any new proposal if appropriate prior to any application to REC.

## **18. AUTHORSHIP PUBLICATION**

All RCTs conducted by CHaRT have a commitment to publish the findings of the research. At a minimum this trial will have a results paper published in a peer-reviewed medical/scientific journal. If all grant-holders and researcher staff fulfil authorship rules, group authorship will be used under the collective title of 'the C-Gall Trial Group'. If one or more individuals have made a significant contribution above and beyond other group members but where all group members fulfil authorship rules, authorship will be attributed to the named individual(s) and the C-Gall Trial Group.

For reports which specifically arise from the trial but where all members do not fulfil authorship rules (for example, specialist sub-study publications), authorship should be attributed to the named individual(s) for the C-Gall Trial Group.

To safeguard the integrity of the main trial, reports of explanatory or satellite studies will not be submitted for publication without prior arrangement from the Project Management Group.

We intend to maintain interest in the trial by publication of C-Gall newsletters at intervals for staff and collaborators. Once the main report has been published, a lay summary of the findings will be sent in a final C-Gall Newsletter to all involved in the trial. Further details on the publication policy can be found in Appendix 3.

## REFERENCE LIST

1. Barbara L, Sama C, Labate AMM. A population study on the prevalence of gallstone disease: The Sirmione study. *Hepatology* 1987;7:913-7.
2. Everhart JE, Khare M, Hill M, Maurer KR. Prevalence and ethnic differences in gallbladder disease in the United States. *Gastroenterology* 1999;117:632-9.
3. Heaton KW, Braddon FEM, Mountford RA, Hughes AO, Emmett PM. Symptomatic and silent gall stones in the community. *Gut* 1991;32:316-20.
4. Williams JG, Roberts SE, Ali MF, Cheung WY, Cohen DR, Demery G, et al. Gastroenterology services in the UK. The burden of disease, and the organisation and delivery of services for gastrointestinal and liver disorders: a review of the evidence. *Gut* 2007;56:1-113.
5. Festi D, Dormi A, Capodicasa S, Staniscia T, Attili AF, Loria P, et al. Incidence of gallstone disease in Italy: results from a multicenter, population-based Italian study (the MICOL project). *World J Gastroenterol* 2008;14:5282-9.
6. Festi D, Reggiani MLB, Attili AF, Loria P, Pazzi P, Scaiola E, et al. Natural history of gallstone disease: Expectant management or active treatment? Results from a population-based cohort study. *J Gastroenterol Hepatol* 2010;25:719-24.
7. Beckingham IJ. ABC of diseases of liver, pancreas, and biliary system: Gallstone disease. *BMJ* 2001;322:91-4.
8. Friedman GD, Raviola CA, Fireman B. Prognosis of gallstones with mild or no symptoms: 25 years of follow-up in a health maintenance organization. *J Clin Epidemiol* 1989;42:1989.
9. Thistle JL, Cleary PA, Lachin JM, Tyor MP, Hersh T. The natural history of cholelithiasis: The National Cooperative Gallstone Study. *Ann Intern Med* 1984;101:171-5.
10. Attili AF, De Santis A, Capri R, Repice AM, Maselli S, Capocaccia L, et al. The natural history of gallstones: The GREPCO experience. *Hepatology* 1995;21:656-60.
11. Berhane T, Vetrhus M, Hausken T, Olafsson S, Sondena K. Pain attacks in non-complicated and complicated gallstone disease have a characteristic pattern and are accompanied by dyspepsia in most patients: The results of a prospective study. *Scand J Gastroenterol* 2006;41:93-101.
12. Schmidt M, Dumot JA, Soreide O, Sondena K. Diagnosis and management of gallbladder calculus disease. *Scand J Gastroenterol* 2012;47:1257-65.
13. Shojaiefard A, Esmaeilzadeh M, Ghafouri A, Mehrabi A. Various techniques for the surgical treatment of common bile duct stones: A meta review. *Gastroenterol Res Pract* 2009 art. no. 840208.
14. Johnston DE, Kaplan MM. Medical progress: Pathogenesis and treatment of gallstones. *New Engl J Med* 1993;328:412-21.

15. Vetrhus M, Soreide O, Eide GE, Nesvik I, Sondenaa K. Quality of life and pain in patients with acute cholecystitis. Results of a randomized clinical trial. *Scand J Surg* 2005;**94**:34-9.
16. Larsen TK, Qvist N. The influence of gallbladder function on the symptomatology in gallstone patients, and the outcome after cholecystectomy or expectancy. *Digest Dis Sci* 2007;**52**:760-3.
17. Bates T, Ebbs SR, Harrison M, A'Hern RP. Influence of cholecystectomy on symptoms. *Br J Surg* 1991;**78**:964-7.
18. Borly L, Anderson IB, Bardram L, Christensen E, Sehested A, Kehlet H, et al. Preoperative prediction model of outcome after cholecystectomy for symptomatic gallstones. *Scand J Gastroenterol* 1999;**34**:1144-52.
19. Gui GP, Cheruvu CV, West N, Sivaniah K, Fiennes AG. Is cholecystectomy effective treatment for symptomatic gallstones? Clinical outcome after long-term follow-up. *Annals of the Roy Coll Surg Engl* 1998;**80**:25-32.
20. Middelfart HV, Kristensen JU, Laursen CN, Qvist N, Hojgaard L, Funch-Jensen P, et al. Pain and dyspepsia after elective and acute cholecystectomy. *Scand J Gastroenterol* 1998;**33**:10-4.
21. Ure BM, Troidl H, Spangenberger W, Lefering R, Dietrich A, Eypasch EP, et al. Long-term results after laparoscopic cholecystectomy. *Br J Surg* 1995;**82**:267-70.
22. Vetrhus M, Berhane T, Soreide O, Sondenaa K. Pain persists in many patients five years after removal of the gallbladder: observations from two randomized controlled trials of symptomatic, noncomplicated gallstone disease and acute cholecystitis. *J Gastrointest Surg* 2005;**9**:826-31.
23. Lamberts MP, Lugtenberg M, Rovers MM, Roukema AJ, Drenth JPH, Westert GP, et al. Persistent and de novo symptoms after cholecystectomy: a systematic review of cholecystectomy effectiveness. *Surg Endoscop* 2013;**27**:709-18.
24. Jorgensen T, Stubbe Teglbjerg J, Wille-Jorgensen P, Bille T, Thorvaldsen P. Persisting pain after cholecystectomy. A prospective investigation. *Scand J Gastroenterol* 1991;**26**:124-8.
25. Ahmed R, Freeman JV, Ross B, Kohler B, Nicholl JP, Johnson AG. Long term response to gallstone treatment - Problems and surprises. *Eur J Surg* 2000;**166**:447-54.
26. Girometti R, Brondani G, Cereser L, Como G, Del Pin M, Bazzocchi M, et al. Post-cholecystectomy syndrome: Spectrum of biliary findings at magnetic resonance cholangiopancreatography. *Br J Radiol* 2010;**83**:351-61.
27. Luman W, Adams WH, Nixon SN, McIntyre IM, Hamer-Hodges D, Wilson G, et al. Incidence of persistent symptoms after laparoscopic cholecystectomy: A prospective study. *Gut* 1996;**39**:863-6.
28. Schmidt M, Sondenaa K, Dumot JA, Rosenblatt S, Hausken T, Ramnefjell M, et al. Post-cholecystectomy symptoms were caused by persistence of a functional gastrointestinal disorder. *World J Gastroenterol* 2012;**18**:1365-72.

29. Bisgaard T, Rosenberg J, Kehlet H. From acute to chronic pain after laparoscopic cholecystectomy: A prospective follow-up analysis. *Scand J Gastroenterol* 2005;40:1358-64.
30. Friedman GD. Natural-History of Asymptomatic and Symptomatic Gallstones. *Am J Surg* 1993;165:399-404.
31. Schmidt M, Sondenaa K, Vetrhus M, Berhane T, Eide GE. Long-term follow-up of a randomized controlled trial of observation versus surgery for acute cholecystitis: Non-operative management is an option in some patients. *Scand J Gastroenterol* 2011;46:1257-62.
32. Brazzelli M, Cruickshank M, Kilonzo M, Ahmed I, Stewart F, McNamee P, et al. Clinical effectiveness and cost-effectiveness of cholecystectomy compared with observation/conservative management for preventing recurrent symptoms and complications in adults presenting with uncomplicated symptomatic gallstones or cholecystitis: a systematic review and economic evaluation. *Health Technol Assess* 2014;18:55.
33. Schmidt M, Sondenaa K, Vetrhus M, Berhane T, Eide GE. A randomized controlled study of uncomplicated gallstone disease with a 14-year follow-up showed that operation was the preferred treatment. *Digest Surg* 2011;28:270-6.
34. Daradkeh S, Sumrein I, Daoud P, Zaidin K, Abu-Khalaf M. Management of gallbladder stones during pregnancy: Conservative treatment or laparoscopic cholecystectomy? *Hepato-Gastroenterol* 1999;46:3074-6.
35. Portincasa P, Di Ciaula A, Wang HH, Moschetta A, Wang DQH. Medicinal treatments of cholesterol gallstones: Old, current and new perspectives. *Curr Med Chem* 2009;16:1531-42.
36. Vetrhus M, Soreide O, Nesvik I, Sondenaa K. Acute cholecystitis: delayed surgery or observation. A randomized clinical trial. *Scand J Gastroenterol* 2003;38:985-90.
37. Vetrhus M, Soreide O, Solhaug JH, Nesvik I, Sondenaa K. Symptomatic, non-complicated gallbladder stone disease. Operation or observation? A randomized clinical study. *Scand J Gastroenterol* 2002;37:834-9.
38. Patient Reported Outcome Measurement G. A structured review of patient-reported outcome measures for patients undergoing cholecystectomy. Report to the Department of Health. *Department of Public Health* 2011.
39. Chen TY, Landmann MG, Potter JC, van Rij AM. Questionnaire to aid priority and outcomes assessment in gallstone disease. *ANZ J Surg* 2006;76:569-74.
40. National Institute for Health & Care Excellence. Guide to the methods of technology appraisal [document on the Internet]. *National Institute for Health and Care Excellence* 2013. <https://www.nice.org.uk/process/pmg9/chapter/foreword> (accessed December 2017)
41. NHS reference costs 2013-14 [website on the Internet]. *UK Department of Health* 2015. URL: <https://www.gov.uk/government/publications/nhs-reference-costs-2013-to-2014> (accessed December 2017)
42. Curtis L. Unit Costs of Health and Social Care 2012 [document on the Internet]. *Personal Social Services Research Unit* 2014. URL: <http://www.pssru.ac.uk/project-pages/unit-costs/unit-costs-2014/> (accessed December 2017)

43. British National Formulary [database on the Internet]. *Medicines Complete* 2015. URL: <https://www.medicinescomplete.com/about/publications.htm> (accessed December 2017)
44. Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. *J Health Econ* 2002;21:271-92.
45. Brazier JE, Roberts J. The estimation of a preference-based measure of health from the SF-12. *Med Care* 2004;42:851-9.
46. Brazier JE, Rowen D, Hamner J. Revised SF-6D scoring programmes: a summary of improvements. *PRO Newsletter* 2008;40:14-5.
47. Kharroubi SA, Brazier JE, Roberts J, O'Hagan A. Modelling SF-6D health state preference data using a nonparametric Bayesian method. *J Health Econ* 2007;26:597-612.
48. NICE Decision Support Unit guidance [website on the Internet]. *NICE Decision Support Unit* 2015. URL: <https://scharr.dept.shef.ac.uk/nicedsu/> (accessed December 2017)
49. Fenwick E, O'Brien BJ, Briggs A. Cost-effectiveness acceptability curves--facts, fallacies and frequently asked questions. *Health Econ* 2004;13:405-15.
50. Lothgren M, Zethraeus N. Definition, interpretation and calculation of cost-effectiveness acceptability curves. *Health Econ* 2000;9:623-30.

## APPENDIX 1 Qualitative study

This trial plans to compare surgical management (cholecystectomy) versus medical management. Due to the interventions being very different it is likely that the trial will face a number of challenges, particularly around informed consent and recruitment, from both the perspective of patients and recruiting clinicians. There are now several surgical trials (funded by NIHR HTA) that include embedded qualitative research that aims to elucidate and inform trial processes and procedures.<sup>1-3</sup>

The aim of the embedded qualitative research is to identify any challenges during the internal pilot relating to design or conduct that can then be addressed and modified before progression to the full trial. This may include changes to the way the trial information is presented, recruitment consultations are framed or requirements for staff training. To achieve this aim, the CGALL-Qual will involve three stages:

1. Audio-recording of recruitment consultation (face-to-face) with potential trial participants
2. In-depth semi-structured telephone interviews with trial participants (consenters, non-consenters, cross-overs, returners and non-returners)
3. In-depth semi-structured telephone interviews with clinical site staff.

As per the details above relating to the internal pilot, four sites (Aberdeen, Nottingham, Royal Free - London and Taunton) have been established for the internal pilot and these sites will be the focus for the first phase of this embedded qualitative research. The use of a small number (n=4) of sites will allow significant investment in establishing the process requirements for embedding this qualitative work. Moreover, demonstrating successful buy-in and implementation of this work across four sites in the pilot should lead to more effective delivery across the remainder of sites during the main trial.

### Equipoise, recruitment and retention

#### Audio-recording of recruitment consultation: Participant invitation and informed consent

The aim of the audio-recording of recruitment consultation is to explore trial decision-making by potential trial participants and clinical site staff (consultant or research nurse) involved in the trial. This will enable the trial team to systematically assess the content and presentation of study information by recruiters, the interactions between participants and recruiters, and provide evidence on which to develop appropriate recruitment strategies. This will also provide evidence about how potential participants can be better supported and informed when making a decision about participation in the C-GALL trial. The audio-recordings will contribute to determining models of 'good practice' for consent discussions which can be used for site training.

Currently, the audio-recording of recruitment consultations is proposed at all sites. As part of the C-GALL trial, potential participants will receive a patient information leaflet (PIL) explaining the trial in detail. To facilitate CGALL-QUAL audio recording of recruitment consultation, a separate PIL will be given to participants, at the same time but before any discussion of the trial is initiated, explaining the purpose and the specific request to audio-record their recruitment consultations. Patients will not be obliged to participate in CGALL-QUAL audio-recording of recruitment consultation and the decision will not affect their invitation to take part in C-GALL.

Following receipt of the CGALL-QUAL information leaflet, and after having the opportunity to ask any questions, willing participants (both potential trial participants and clinicians) will be asked to verbally confirm they consent to their recruitment consultations being audio-

recorded. Recruitment consultations will be routinely recorded and after an initial greeting and introduction to the consultation, verbal consent for recording will be sought from participants. If a participant says yes to recording the recording will continue and there will be a record of consent (having a record of consent is the reason the recording will start before asking for consent). If a participant says no, the audio recording will be stopped and the file will be deleted. Participants will be able to withdraw their consent at any time. Verbal consent obtained in this manner has been approved for other similar randomised controlled trials with embedded qualitative monitoring of recruitment and retention (e.g. IRAS project ID 226009: 'A randomised control trial to assess the impact of a lifestyle intervention (ActWELL in women invited to NHS breast screening').

#### *Interviews with potential trial participants: Participant invitation and informed consent*

In depth semi-structured interviews with consenters (including those who consent and go on to cross-over to surgical management intervention/medical management) and non-consenters for the RCT, returners and non-returners of the follow-up questionnaires (during 3, 9, 12, 18 and 24 months and 6 monthly thereafter, post randomisation, till end of trial) will be conducted alongside the C-GALL trial. In addition, participants who intentionally withdraw from the trial will be contacted and asked to participate in in-depth semi-structured interviews to investigate whether there were specific aspects of trial design or conduct that led to their decision to terminate their involvement. The findings of these interviews will help us to understand perspectives of participation/non-participation (considerations when deciding to participate/not participate in C-GALL), returning/not returning questionnaires (considerations when deciding to return/not-return a follow-up questionnaire), equipoise (opinions about the different treatment options and cross-over where appropriate) and continued participation (considerations when deciding to withdraw from the trial).

Topic guides will be developed for each group and cover aspects of trial rationale, design and conduct with a specific focus on illuminating the trial recruitment pathway (originating from primary care) and considerations of consent for potential participants. Both the 'cross-overs' and the 'non-returners' will be identified from the CGALL database at any of the follow-up points i.e. 3, 9, 12, 18 and 24 months and 6 monthly thereafter, post randomisation, till the end of the trial.

For all interviews, expression of potential participants' interest in taking part in CGALL-Qual will be taken using an opt-in invitation immediately post-decision (informed consent) about CGALL participation. Potential participants will be provided with a CGALL-QUAL Interview PIL in the clinic or the PIL will be posted to the participant if a decision about trial entry is made later. The PIL will contain a detachable reply-slip to complete and return to the researcher (in a reply paid envelope) if they would like to discuss participating in the CGALL-Qual Interview study. Those participants who do not return an interest slip will not be further contacted for participation in CGALL-Qual. Following receipt of the completed slip, the researcher will telephone the interested participant and ensure they are clear about what the study entails and arrange a suitable time for the interview.

Interviews will be planned to be as close as possible to the initial decision to participate/not-participate or randomisation. To enable all willing participants to be involved in the interview study, and maximize sample variability, telephone interviews will be utilised. Before the interview date, the consent form will be posted to the participant, with a reply paid envelope, and they will be asked to sign and return to the researcher. The researcher will then countersign the consent form and ensure the participant is provided with a copy for their

records. As with all research studies, participants will be able to withdraw consent at any time.

#### *Interviews with site staff: Participant invitation and informed consent*

To complement the audio-recordings of recruitment consultations and interviews with trial participants, clinical and recruitment staff (consultants, research nurses) involved in the trial recruitment at each site will be invited to participate in telephone interviews to explore their understanding of the trial (specifically with regard to eligibility criteria, beliefs about equipoise, and process). Other studies have conducted interviews with trial staff and used the findings from these interviews to address misunderstandings, amend trial process and improve overall recruitment.<sup>4-6</sup>

Site staff will be emailed an invitation letter outlining the study and inviting them to contact the research team (by email or telephone) if interested in participating in the interview study. Once contact is made with the researcher, potential participants will have the opportunity to ask any further questions before making a decision to participate. Before the interview date, the consent form will be posted to the participant, with a reply paid envelope, and they will be asked to sign and return to the researcher. The researcher will then countersign the consent form and ensure the participant is provided with a copy for their records. As with all research studies, participants will be able to withdraw consent at any time.

#### *Data collection and analysis*

##### *Audio-recording of recruitment consultation: data collection*

All recruitment consultations across sites will be audio-recorded for those participants who consent. All conversations related to G-GALL trial (where recruiters explain the design and details of the C-GALL RCT, and patients decide whether or not to take part) from the recordings will be transcribed for the purpose of analysis and discussion i.e. targeted transcription. In addition, a novel mixed-methods approach as suggested by Donovan et al,<sup>7</sup> combining appointment/consultation timings (time spent explaining aspects of the RCT will be documented) and qualitative interpretation of the conversation- 'quanti-qualitative appointment timing' (Q-QAT) may be used for the purpose of analysis as appropriate. This will provide useful information regarding the order of presentation (balanced/unbalanced presentation of the RCT information to potential participants inspiring or hindering recruitment) and degree of balance between the RCT interventions, the time the RCT is first mentioned and how long is devoted to it.<sup>8</sup>

At least 10 consultations per site will be analysed at the beginning and the results will be presented to local clinical investigator (CI) and trial management group (TMG) for discussion and further practice improvement. No identifiers of individuals or clinical centres will be shown in presentations. If the findings provide clear reasons why recruitment to the RCT may not be achievable, the CGAL-QUAL researchers will prepare a report (presenting a generic potential plan of action to improve recruitment-/process based on the findings overall and also will include some suggestions to address any specific site issues) for the CI/TMG to facilitate their decision making. . The contents of the plan and responsibilities for implementation will be finalised based on the discussions with the CI/TMG.

### *Interviews with trial participants and site staff: data collection*

For both the C-GALL trial participants and the site staff interviews, approximately 15 interviews each will be conducted by sampling informed by Francis et al.<sup>9</sup> To provide 15 participants for the patient group it is anticipated that a total of 60 CGALL-Qual interview PILs will require to be distributed (anticipate participation rate of ~20%). All staff at each pilot site will be sent an email regarding invitation to participate in this interview study. If the number interested exceeds the sample required, participants will be sampled purposively to ensure a wide variety of experiences is included in the sample. All interviews will last approximately 30-60 minutes and will be audio-recorded and transcribed verbatim using professional transcription service.

### *Audio-recordings and interviews: data analysis*

All recordings (from both recruitment consultations and interviews) will be anonymised and labelled with the unique identifier, to ensure confidentiality. All data will be thematically analysed using a modified framework approach facilitated by the use of NVivo. The use of the Framework approach will allow a priori themes to be explored within the transcripts (e.g. treatment preferences, decision making about eligibility, etc) but also allow room for incorporation of themes that emerge de novo from the data.

Recruitment consultation data will be analysed techniques to identify aspects of informed consent that are problematic. The transcripts of the consultations will be analysed using content and thematic<sup>10</sup> to elucidate reasons for imbalances in presentation, style and content of information provided by the recruiter, participation and engagement of patient, and indications of the presence and origin of 'hidden challenges'. Interview data will be specifically explored for recruiters' difficulties with key aspects of the RCT design and perceived conflicts between clinical and research roles, and the emotional and intellectual challenges they experience when attempting to recruit patients).<sup>7</sup> The findings will help targeting and optimising support for site staff, recruiters, and potential participants, to improve the informed consent process. In addition, analysis will take the form of constant comparison alongside case study methods both within and across sites and individuals to determine problem areas or identify aspects of good practice.

With regard to exploring aspects of trial retention, the audio-recordings and observations described above will also be analysed for discussions relating to trial follow-up procedures and the importance placed on the commitment to the trial across the entire timeline. Specific analysis methods will be as described above.

### *Participant flow*

Alongside the primary qualitative data, an in depth analysis of participant flow at each recruiting site will be conducted.

A log of patients, using the SEAR framework (as proposed by Donovan and colleagues 2016),<sup>7</sup> will be assessed alongside discussions with staff to identify areas of complexity and protocol compliance. For example, Screening logs (containing information on number of potential participants screened) and each patients screened will receive a screening number. Eligibility (including whether they met the protocol inclusion/exclusion criteria, and for what reason they were deemed ineligible) and whether they (eligible) were approached about the

trial participation (if not, why) and finally whether they were randomised and if not-why and which treatment they received)

Simple counting of data collected in SEAR logs can provide useful information about the complexity of the recruitment process, differences between centres or over time can give indications of difficulties that can be investigated further. These data will be compared across sites to illustrate any variation between centres and again identify areas of good practice that can be shared.

### Study Management

CGALL-QUAL will be led by two experienced qualitative researchers, with input and guidance from the Trial Project Management Team. The qualitative research team will conduct the interviews and lead data analysis. Specifically, they will be responsible for organising transcription, ensuring secure transfer of digital audio files to the transcriber and subsequent anonymisation of transcripts. File transfer will be conducted according to the current guidelines laid out in the University of Aberdeen's operating procedures. The qualitative researchers will also be responsible for organising appropriate storage of the digital files and transcripts, which will be stored on password protected University computers that are backed up on a secure SQL server. Data analysis will be led by the qualitative research team. In addition, the audio recording of the consultation will be managed (including managing recording device and upload recordings to CGALL-Qual study folder) by a research nurse.

### Impact of embedded qualitative research

Results from all aspects of the qualitative work will be fed back (as anonymised summaries) to the Project Management Group (PMG) both during and at the end of the first stop/go phase of the internal pilot (month 12). Potential solutions in the form of action plans will be developed by the qualitative team and PMG in tandem, implemented and evaluated (through improvements in recruitment and retention) on a rolling case basis. The qualitative work will further extend into the next phase (months 12-24) and can be used during site set up to identify areas of concern and during periods of follow up to improve retention across sites.

### Timeline

Following ethical approval (obtained on 13/5/2016 REC reference number: 16/NS/0053, the audio recording of recruitment consultations will begin as soon as the process for inviting potential participants (both trial participants and site staff) commences. It is anticipated that this could start in August 2016 in Aberdeen and the other three sites (Nottingham, University College- London and Taunton) will commence in 2017.

It has been anticipated that approximately two participants per month will give consent for randomisation in CGALL trial. Therefore, we are proposing a 3 month recruitment window per site to recruit ~ 15 eligible participants per site for in depth interviews, which will change accordingly if necessary (e.g. delays in regulatory approvals or numbers needed to recruit). As an example, for Aberdeen it will be from start of August 2016 to end of November, 2016. Full data analysis will take a further 5 months and would be completed by end of April, 2017, with write up for an interim analysis report (presenting the findings to date) to feedback to the HTA which will be completed by end of June, 2017.

### Ethical considerations

The study will be conducted according to the principles of good clinical practice provided by Research Governance Guidelines. Some aspects of this qualitative evaluation, as proposed initially, have raised ethical concerns such as the processes of contacting participants who have refused to take part in C-GALL to invite them to participate in an interview. Efforts have been made to ensure participants invited to interview feel able to make an informed, voluntary, decision about their participation.

1. Abrams P, Shearer K. The MASTER trial: artificial urinary sphincter versus male sling. *Trends Urol Men's Health* 2015;6:37-8.
2. Donovan J, Mills N, Smith M, Brindle L, Jacoby A, Peters T, et al. Quality improvement report: Improving design and conduct of randomised trials by embedding them in qualitative research: ProtecT (prostate testing for cancer and treatment) study. Commentary: presenting unbiased information to patients can be difficult. *BMJ* 2002;325:766-70.
3. Rogers CA, Welbourn R, Byrne J, Donovan JL, Reeves BC, Wordsworth S, et al. The By-Band study: Gastric bypass or adjustable gastric band surgery to treat morbid obesity: Study protocol for a multi-centre randomised controlled trial with an internal pilot phase. *Trials* 2014;15:53.
4. Paramasivan S, Huddart R, Hall E, Lewis R, Birtle A, Donovan JL. Key issues in recruitment to randomised controlled trials with very different interventions: a qualitative investigation of recruitment to the SPARE trial (CRUK/07/011). *Trials* 2011;12:78.
5. Potter S, Mills N, Cawthorn SJ, Donovan J, Blazeby JM. Time to be BRAVE: Is educating surgeons the key to unlocking the potential of randomised clinical trials in surgery? A qualitative study. *Trials* 2014;15:80.
6. Ziebland S, Featherstone K, Snowdon C, Barker K, Frost H, Fairbank J. Does it matter if clinicians recruiting for a trial don't understand what the trial is really about? Qualitative study of surgeons' experiences of participation in a pragmatic multi-centre RCT. *Trials* 2007;8:4.
7. Donovan JL, Rooshenas L, Jepson M, Elliott D, Wade J, Avery K, et al. Optimising recruitment and informed consent in randomised controlled trials: The development and implementation of the Quintet Recruitment Intervention (QRI). *Trials* 2016;17:283.
8. Paramasivan S, Strong S, Wilson C, Campbell B, Blazeby JM, Donovan JL. A simple technique to identify key recruitment issues in randomised controlled trials: Q-QAT - Quantitative Appointment Timing. *Trials* 2015;16:88.
9. Francis JJ, Johnston M, Robertson C, Glidewell L, Entwistle V, Eccles MP, et al. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychol Health* 2010;25:1229-45.
10. Sidnell J, Stivers T. The handbook of conversation analysis. Chichester: John Wiley & Sons; 2012

## APPENDIX 2 Development of core outcome set

Recommendations from the recent NICE guideline on Gallstone Disease<sup>1</sup> have clearly demonstrated insufficient information for patients on the effect of cholecystectomy on patient outcomes. The Guideline recommends “research is needed to establish the long-term patient benefits and harms, so that appropriate information can be provided to patients to aid decision-making and long-term management of their condition.” The only disease specific outcome measure with good measurement properties in gallstone disease is the Otago gallstones condition-specific questionnaire. The questionnaire was developed on patients that were being considered for a cholecystectomy and covered a range of disease severity. It was not however, developed using patients that had undergone a cholecystectomy or long-term medical management once eligible for surgery. Therefore key important outcomes for longer term follow-up may be missing. Given our proposed trial study will be working with an independent PPI group, we propose to tackle the Guideline recommendation cost-efficiently by developing a core outcome set for symptomatic uncomplicated gallstone disease using a Nominal Group Technique.

Core outcome sets are agreed standardised sets of outcomes that represent the minimum that should be measured (and reported) in trials of a specific condition.<sup>2</sup> There is currently no agreed published core outcome set for symptomatic uncomplicated gallstone disease. Generally, the methodology describing the development of a core outcome set encompasses three key stages: 1. A review of the literature to identify outcomes reported to date; 2. Interviews with patients to explore additional outcomes of importance; and 3. A consensus based approach to determine which outcomes should be considered core. This methodology will be adopted to develop a core outcome set for symptomatic uncomplicated gallstone disease alongside the main trial.

A recent systematic review led by our team<sup>3</sup> identified two trials of cholecystectomy versus medical management. This review will be supplemented with additional randomised studies that report outcomes in symptomatic uncomplicated gallstone disease (e.g. trials of early versus delayed laparoscopic cholecystectomy for uncomplicated biliary colic). The qualitative interviews in the embedded qualitative research component of the trial (see Appendix A), will be used as a way to identify additional potential outcomes of importance (to both patients and clinicians) that are not identified from the literature search. These outcomes (identified in the review and qualitative interviews) will be generated into a list and distributed by postal questionnaire to upper GI surgeons and the study PPI group. Responders will be asked to rate the importance of each outcome for inclusion in a core outcome set. Initial analysis of the questionnaire will aim to identify a shortlist of outcomes for further discussion at consensus meeting. Following initial analysis of this questionnaire a Nominal Group Technique (NGT), a face-to-face meeting of stakeholders that aims to generate consensus, will be conducted. The NGT will involve key stakeholders (patients and clinicians) and will summarise and discuss the questionnaire results with an additional round of anonymised rating to determine the final core set. It is anticipated that this set will consist of no more than 10 individual outcomes. This core outcome set work will be registered with the COMET Initiative, an international initiative to bring together people interested in developing core outcome sets (<http://www.comet-initiative.org/>).

1. Gallstone disease. NICE Clinical Guideline CG188 [document on the Internet]. National Institute for Health and Care Excellence 2014.

2. Williamson PR, Altman DG, Blazeby JM, Clarke M, Devane D, Gargon E, et al. Developing core outcome sets for clinical trials: Issues to consider. *Trials* 2012;13:132.

3. Brazzelli M, Cruickshank M, Kilonzo M, Ahmed I, Stewart F, McNamee P, et al. Clinical effectiveness and cost-effectiveness of cholecystectomy compared with observation/conservative management for preventing recurrent symptoms and complications in adults presenting with uncomplicated symptomatic gallstones or cholecystitis: a systematic review and economic evaluation. *Health Technology Assessment* 2014;18:55.

## APPENDIX 3: Authorship Policy

### 1. PRINCIPLES OF AUTHORSHIP

The following principles of authorship have been derived from editorial publications from leading journals (see references) and are in accordance with the rules of the International Committee of Medical Journal Editors.

#### a. Group authorship

Group authorship will be appropriate for some publications, such as main reports. This will apply when the intellectual work underpinning a publication 'has been carried out by a group, and no one person can be identified as having substantially greater responsibility for its contents than others'.<sup>1</sup> In such cases the authorship will be presented by the collective title - The C-Gall Trial Group - and the article should carry a footnote of the names of the people (and their institutions) represented by the corporate title. In some situations one or more authors may take responsibility for drafting the paper but all group members qualify as members; in this case, this should be recognised using the by-line 'Jane Doe and the Trial Group'.<sup>2</sup> Group authorship may also be appropriate for publications where one or more authors take responsibility for a group, in which case the other group members are not authors but may be listed in the acknowledgement (the by-line would read 'Jane Doe for the Trial Group').<sup>2</sup>

#### b. Individual authorship

Other papers, such as describing satellite studies, will have individual authorship. In order to qualify for authorship an individual must fulfil the following criteria<sup>1</sup>:

- i. each author should have participated sufficiently in the work represented by the article to take public responsibility for the content.
- ii. participation must include three steps:
  - conception or design of the work represented by the article OR analysis and interpretation of the data OR both; AND
  - drafting the article or revising it for critically important content; AND
  - final approval of the version to be published.

Participation solely in the collection of data is insufficient by itself. Those contributors who do not justify authorship may be acknowledged and their contribution described.<sup>1</sup>

#### c. Determining authorship

Tentative decisions on authorship should be made as soon as possible<sup>1</sup>. These should be justified to, and agreed by, the Project Management Group. Any difficulties or disagreements will be resolved by the Steering Committee.

### 2. AUTHORSHIP FOR PUBLICATION ARISING FROM C-GALL TRIAL

#### a. Operationalising authorship rules

We envisage two types of report (including conference presentations) arising from the C-Gall trial and its associated projects:

##### i. *Reports of work arising from the main C-Gall trial*

If all grant-holders and research staff fulfil authorship rules, group authorship should be used under the collective title of 'The C-Gall Trial Group'; if one or more individuals have made a significant contribution above and beyond other group members but where all group members fulfil authorship rules, authorship will be attributed to 'Jane Doe and the C-Gall Trial Group'.

##### ii. *Reports of satellite studies and subsidiary projects*

Authorship should be guided by the authorship rules outlined in Section 1 above. Grant-holders and research staff not directly associated with the specific project should only be

included as authors if they fulfil the authorship rules. Grant-holders and research staff who have made a contribution to the project but do not fulfil authorship rules should be recognised in the Acknowledgement section. The role of the C-Gall Trial Group in the development and support of the project should be recognised in the Acknowledgement section. The lead researcher should be responsible for ratifying authorship with the Project Management Group.

For reports which specifically arise from the C-Gall trial but where all members do not fulfil authorship rules (for example, specialist sub-study publications), authorship should be attributed to 'Jane Doe for the C-Gall Trial Group'. If individual members of the group are dissatisfied by a decision, they can appeal to the Management Group for reconciliation. If this cannot be achieved, the matter should be referred to the Steering Group.

#### **b. Quality assurance**

Ensuring quality assurance is essential to the good name of the trial group. For reports of individual projects, internal peer review among members of the Project Management Group is a requirement prior to submission of papers. All reports of work arising from the C-Gall trial including conference abstracts should be peer reviewed by the Project Management Group.

The internal peer review for reports of work arising from the C-Gall project is mandatory and submission may be delayed or vetoed if there are serious concerns about the scientific quality of the report. The Project Management Group will be responsible for decisions about submission following internal peer review. If individual members of the group are dissatisfied by decisions, the matter may be referred to the Steering Group.

The Project Management Group undertakes to respond to submission of articles for peer review at the Project Management Group Meeting following submission (assuming the report is submitted to the trial secretariat in Aberdeen at least two weeks prior to the meeting).

### **3. REFERENCES**

1. Huth EJ (1986). Guidelines on authorship of medical papers. *Annals of Internal Medicine*, **104**, 269-274.
2. Glass RM (1992). New information for authors and readers. Group authorship, acknowledgements and rejected manuscripts. *Journal of the American Medical Association*, **268**, 99.