Trustworthy Parameter in Delayed Cholecystectomy using analytic hierarchy process

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ABSTRACT

Delayed cholecystectomy after 6 weeks of onset of acute cholecystitis is regarded as a standard option by many surgeons during management of acute cholecystitis as those surgeons wait for subsiding of acute inflammation aiming for decreasing morbidity and mortality. There are some parameters that are can be dependable and have an importance when surgeons select delayed cholecystectomy as an preferred option. In this study the analytic hierarchy process is used to assess the optimum parameter that the surgeons can depended on it when choosing delayed cholecystectomy in cholecystitis cases. Consultant surgeons working at baqubah teaching hospital with good surgical expereince give data to this study and from these data the weights of all parameters are calculated .These parameters involve Operative time, Intaopertive complications, Postoperative compilcations, Length of Stay in the hospital. The Intaopertive complications include (bleeding,common bile duct injury, visceral injury), the Postoperative compilcations include (wound infection, intraabdominal infection,bile leak,deep venous thrombosis). Depending on the surgeons preferences between the study parameters, the weight for each parameter is calculated in the study matrix and so, the highest weight parameter is considered as the best one to be depended. The highest value mean was recorded for the Intaopertive complications (IOC) with value equal to 0.437 with standard deviation equal to 0.245185. So, the Intaopertive complications is regarded as the most important and dependable parameter when choosing delayed cholecystectomy in the management of acute cholecystitis.

Keywords: Trustworthy Parameter, Delayed Cholecystectomy, analytic hierarchy process

Introduction

Acute cholecystitis is defined as an inflammation of the gallbladder [1]. acute calculous cholecystitis can be defined as an acute inflammation of the gallbladder that is triggered by a gallstone obstruction to the gallbladder neck or cystic duct [2].

The liver cells (the hepatocytes) produce a solution called the(bile) which play rule in fat digesion and this bile is stored in the gallbladder which will contract and push the bile into the duodenum through the common bile duct in responce to food ingestion with fat content[3].

The mechanism of acute cholecystitis including blockage of cystic duct[1]. This will results in exposure of the mucosal epithelium to the effect of bile due to destruction of the normal mucous layer inside the gallbladder and together there will be gallbladder distension with increasing intramural pressure, compromising the blood flow and bacterial

contamination[2]. So,acute cholecystitis is regarded as a serious complication of gallstones[4].

In 90-95% of cases of acute cholecystitis there is an association with the gallstones[5]. The incidence of acute cholecystitis is increasing throughout the world[6]. Mortality in cases of acute cholecystitis may reach to 3 %[4]. The management of acute cholecystitis is in continuos evolvement and in the USA this management need precise clinical decision and surgical skills and this is improved by advancement in the grading system and diagnostic tools such as Tokyo guidlines[7]. Depending on these guidlines , the accurate diagnosis includes clinial, labaratory and imaging criteria and so clinically the patient with acute cholecystitis should have right upper quadrent abdominal pain (usually not remitting), tenderness, gaurding with positive murphy's sign and fever together with labaratory findings of leukocytosis with or without (CRP more than or equal to 3 mg/dl)and may be mild jaundice[8].

Complications of acute cholecystitis may include mucocele, empyema, gallbladder gangrene, perforation of gallbladder, fistula, gallstone ilius[9]. CT scan can demonstrates the same findings of U/S in acute cholecystitis but with less sensitivity while Ultrasonography (U/S) is regarded as the most important imaging test as it is effective in showing gallbladder wall thickness, pericholecystic fluid, gallstones, sonographic murphy's sign [10]. The initial management of acute cholecystitis including intravenous fluids, antibiotics, and may be electrolytes before surgical management[11]. Cholecystectomy is defined as the removal of gallbladder surgically[12]. Cholecystectomy is the standard for the treatment of acute cholecystitis[13].

There are two approachs for cholecystectomy either open or laparascopic approach[14].

The first who performed cholecystectomy is Langenbuch in 1882. John Stough Bobbs performed the first cholecystestomy and removed gallstones in 1867[15].

The gold standard in acute calculous cholecystitis treatment is laparascopic cholecystectomy[16].

The usual management of acute cholecystitis includes control of inflammation of the gallbladder with cholecystectomy after 6-8 weeks but this approach is associated with increased risk of other acute attacks during waiting period and gallstones related complications[17].

There is controversy about the optimum timing for cholecystectomy in those patients who are clinically ill[18].

The timing of cholecystectomy inludes early cholecystectomy and delayed cholecystectomy[19].

Early approach is cholecystectomy during admission to hospital[20].

Delayed approach is cholecystectomy after a period of 6-8 weeks of the acute inflammation[19].

The delayed cholecystectomy after a period of conservative treatment is still common choice in many centers[21].

The analytic heirarachy process is used to give a priority to the criteria depending on their importance[22].

AHP is an inclusive system that is used to make decisions with multiple criteria[23].

The purpose of this study is to choose the best and optimum parameter that surgeons should depend while making decision to select delayed cholecystectomy as an approach of choice in the management of acute cholecystitis by the use of analytic hierarchy process depending on experience of a group of surgeons.

Literature review

Emmy et al (2020) mention that cholecystitis management with antibiotics, analgesia and drainage of gallbladder is regarded as a feasible option and also as a bridge to the final step of treatment by cholecystectomy[24].

Christopher et al (2019) deduce that patients with Tokyo grade 2 and more may develop more complications and more hospital charges if early cholecystectomy is done for them at same admission for acute cholecystitis[25].

Danny et al (2019) mention that US surgeons prefer conservative treatment for cases with

symptoms more than 72 hours till 4-6 weeks when they do cholecystectomy[7].

Yuksekdag et al (2021) conclude that early approach is safe within 7 days of onset of symptoms of acute cholecystitis[26].

Jamal et al (2020) mention that early cholecystectomy within 7 days is feasible and safe in the management of acute cholecystitis and associated with major economic benefit for patient and health system with less hospital stay[19].

Gursimranjit et al (2020) conclude that early appraoch cholecystectomy is associated with less hospital stay is more economical[6].

Tom et al (2019) study outcome go with the fact that early cholecystectomy within 72 hours has the advantages of less intraoperative conversion, decreased postoperative biliary related complications and less hospital stay[27].

Methadology:

This study aimed to investigate the best and trustworthy parameter that can help the surgeons in their decision of delayed cholecystectomy after 6 weeks of onset of acute cholecystitis by using the analytic hierarchy process(AHP) by which the weights of all criteria listed below will be assessed.

The criteria used in this study are : Intaopertive complications (IOC) which include (bleeding,common bile duct injury, visceral injury), Operative time(OT) which is the time between the first incision and final closure, Postoperative compilcations(POC) which involve (wound infection, intraabdominal infection,bile leak,deep venous thrombosis) and the Length of Stay in the Hospital (LOS).

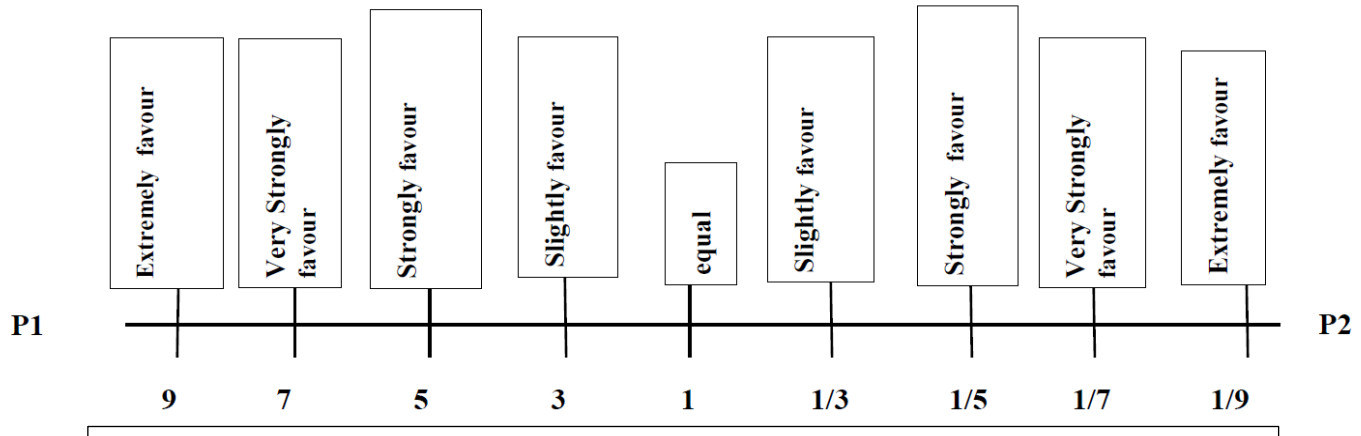
Actually, the numerical values in the study scale represent the opnions of doctors and these numerical values are inserted in the study matrix. Consistency ratio(CR) is important in the assessment of the consistency of our study. This ratio should be equal or less than 1.

So the consistency ratio is significant as indicator of the accuracy of the study results and if the consistency ratio result is more than 1 this indicate an inconsistency.

The surgeons that particpate by their knowledge are general surgery consultants at baqubah teaching hospital.

They give the weights of the above criteria through the pairwise comparison between each two given criteria.

In this study the weights of criteria from experts choices were collected through the answers of the consultant surgeons according to their preference and their experience and then the comparison scale is used to assess these answers as numerical values which will be arranged in the study matrix.



Srtructure (1) showing the pairwise comparison scale (P represnt a parameter)

There are fundamental measures that are corresponding to the numerical values that are fixed in the comparison scale and these measures are shown in the table (1) below:

Table (1) showing fundamental measures and their descriptions:

Priority of measure	Description of measure
1	Equal favour
2	Slight favour
3	Strong favour
4	Very srtong favour
5	Extreme favour

The criteria weights are inserted in the compairison matrix below which showing data of delayed cholecystectomy after 6 weeks of acute attack

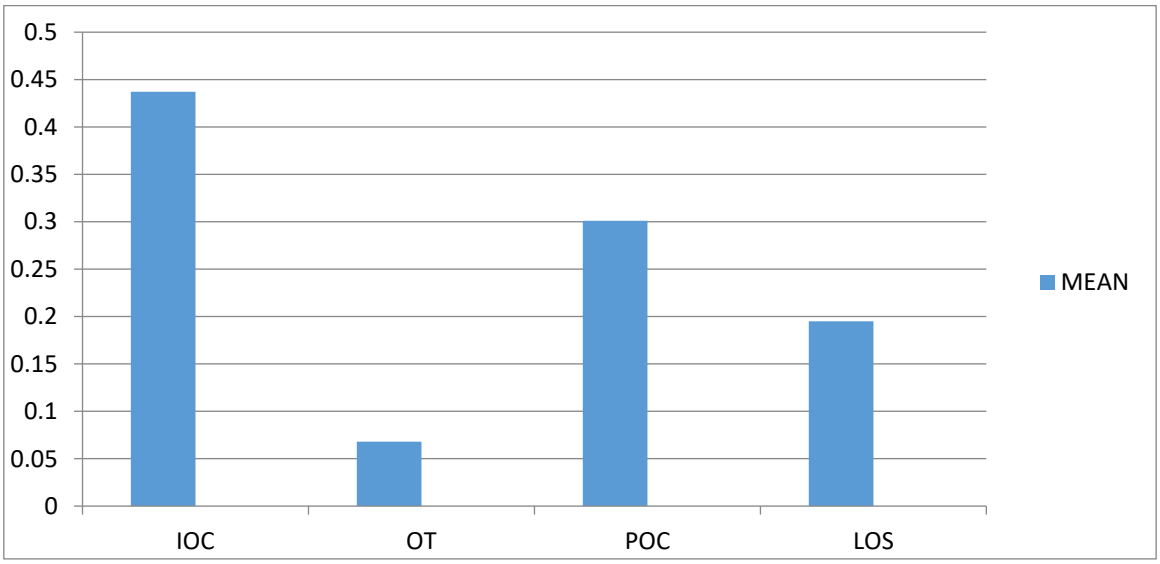
Table (2) showing weights of parameters in delayed cholecystectomy after 6 weeks(ex. indicating the expert):

Criteria weights for cholecystectomy after 6 weeks				
Criteria	**IOC**	**OT**	**POC**	**LOS**
Ex.1	**0.154**	**0.060**	**0.580**	**0.205**
Ex.2	**0.619**	**0.080**	**0.261**	**0.040**
Ex.3	**0.663**	**0.059**	**0.188**	**0.089**
Ex.4	**0.311**	**0.072**	**0.173**	**0.444**

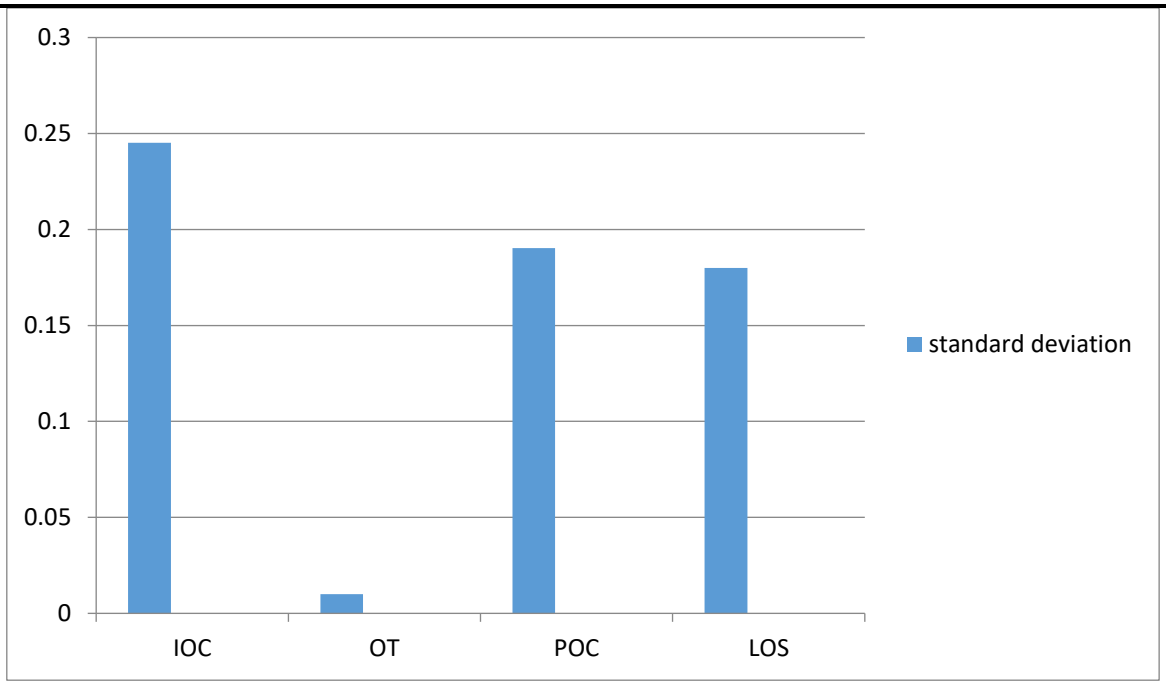
The statistical values(mean and standard deviation) are calculated for all criteria weights that are given by the experts and the mean and a standard deviation is assessed for each criterion as shown below in table (3) and diagrams (1),(2)

Tables (3) showing mean and a standard deviation values in cholecystectomy aftrer 6 weeks of onset of acute cholecystitis:

criteria	**IOC**	**OT**	**POC**	**LOS**
mean	**0.437**	**0.068**	**0.301**	**0.195**
stadev	**0.245185**	**0.009969**	**0.190376**	**0.179962**



Diagram(1) showing mean values in delayed cholecystectomy



Diagram(2) showing standard deviation values in delayed cholecystectomy

Results and Discussion

Each surgeon give weights to four parameters or criteria in delayed cholecystectomy cases in acute cholecystitis. By using analytic hierarchy process method, the parameters weights were calculated based on expert surgeons prferences. The priority and the best parameter to be dependable is the highest weight parameter. The highest weights in the study matrix were recorded as following(POC=0.580 recorded by expert 1)(IOC = 0.619 recorded by expert 2)(IOC = 0.663 recorded by expert 3)(LOS=0.444 rdecord by expert 4) and the highest value mean was recorded for IOC with value equal to 0.437 with standard deviation equal to 0.245185.

Conclusion

The study conclusion is that intraoperative complications (IOC) is the most important and trustworthy parameter to be dependable when the surgeons select delayed cholecystectomy as an approach of choice in acute cholecystitis management after the first 6 weeks following the onset of acute inflammation.

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Questionnaire for the assessment of the optimum timing of cholecystectomy after 6 weeks of onset of acute cholecystitis

- Name :
- Speciality :
- Experience duration;
- This quesionaire involving a pair wise comparison between the parameters that are involved in this study.
- The parameters (P) are:

1. Intaopertive complications(IOC):(bleeding,common bile duct injury, visceral injury).
2. Postoperative compilcations(POC): (wound infection,intraabdominal infection,bile leak,deep venous thrombosis)
3. Operaative time(OT): is the time between the first incision and final closure.
4. Length of Stay in the Hospital (LOS).