



## ROLE OF LAPAROSCOPY IN ACUTE ABDOMEN IN EMERGENCY

### Surgery

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### ABSTRACT

**Context:** Laparoscopic surgery has been described in many abdominal emergencies, such as acute appendicitis, blunt and penetrating trauma, peritonitis, acute cholecystitis, acute small bowel obstruction and non specific abdominal pain. As the surgical experience and technology have improved so have the number of patients who are being subsequently managed exclusively with laparoscopic surgery.

**Aims:** To study and evaluate the diagnostic and therapeutic efficacy of laparoscopy in surgical emergencies and applicability, advantages, limitations, and complications associated with the use of laparoscopy in surgical emergencies in our group of patients.

**Settings and Design:** The present study was conducted prospectively in our hospital for a period of 2 year.

**Methods and Material:** The study was conducted on 37 patients who were admitted in the surgical casualty with complaints of abdominal pain.

**Results:** The pre-operative diagnosis was confirmed in 26 out of 37 patients(70%) and the diagnosis was changed in 11(30%) of patients. A definitive diagnosis was made in 35 cases (94.6%) after diagnostic laparoscopy and only 2(5.4%) patients were left without a diagnosis after diagnostic laparoscopy.

Thirty (81%) patients underwent therapeutic laparoscopic procedures (19 appendectomies; 8 cholecystectomies; 1 adhesiolysis; 1 liver biopsy; 1 cholecystostomy) and 4(10.8%) patients underwent laparoscopy for diagnostic purpose only.

**Conclusions:** Routine laparoscopy for the acute abdomen is safe and accurate. In addition to establishing a clear diagnosis, it also confers important therapeutic benefits. A laparoscopic unit which is completely dedicated to undertake laparoscopic procedure during day and night in various abdominal emergencies will greatly enhance the efficacy and applicability of laparoscopy and will extend the benefits of this technology to a large sub-set of patients which will be cost-effective in the long run.

### KEYWORDS

laparoscopy, obstruction, acute abdomen, NSAP

### INTRODUCTION

The emergence of laparoscopy in the late 1980's as a credible therapeutic intervention heralded a new surgical age. Initially laparoscopy was limited to elective surgery but as technology and surgical experience expanded so did the application of laparoscopy into the emergency setting<sup>1</sup>.

Surgeons can use video laparoscopy in cases of abdominal emergencies for the following situations:

- 1) Diagnosis only (e.g. patients with abdominal pain due to endometriosis)
- 2) Diagnosis and treatment (e.g. patients with abdominal pain secondary to acute appendicitis)
- 3) Treatment only (e.g. patients with acute cholecystitis)
- 4) Indicating the best place to make an incision in cases where conversion to laparotomy is absolutely necessary.

However, the primary aim of laparoscopy in the emergency setting is diagnostic as evidenced by high definitive diagnostic rates between 86-100% in unselected patients<sup>2,3,4</sup>. Also as the surgical experience and technology have improved so have the number of patients who are being subsequently managed exclusively with laparoscopic surgery<sup>5,6</sup>. Laparoscopic surgery has now been described in many abdominal emergencies, such as acute appendicitis, blunt and penetrating trauma, peritonitis, acute cholecystitis, acute small bowel obstruction and non specific abdominal pain.

### AIMS AND OBJECTIVES

1. To study the efficacy of diagnostic laparoscopy and evaluate the therapeutic efficacy of laparoscopy in surgical emergencies (acute abdominal pain of non-specific origin, abdominal trauma, acute appendicitis, acute cholecystitis, peritonitis and perforated peptic ulcer).
2. To study the applicability, advantages, limitations, and complications associated with the use of laparoscopy in surgical emergencies in our group of patients.

### MATERIALS AND METHODS

The present study was conducted prospectively in the Post-graduate Department of Surgery, in our hospital for a period of 2 year.

The study was conducted on 37 patients who were admitted in the surgical casualty with complaints of abdominal pain. The following patients were excluded from the study:

1. Patients with clinico-radiological evidence of acute intestinal obstruction.
2. Hemo-dynamically unstable patients.
3. Patients with two or more previous abdominal surgeries.

After a detailed clinical history patients were assessed according to following protocol:

1. Thorough general physical examination and systemic examination was done in every patient
2. Routine blood investigations and relevant investigations (X-Ray Chest (P/A View), ECG, USG Abdomen, CECT abdomen when indicated) were done.

A provisional diagnosis was made in all patients based on clinical history, examination and radiological features. Thereafter, laparoscopy was done in all cases within 48-72 hours of admission. A diagnosis was thereby made on the basis of laparoscopic findings. The criteria used for the clinic-radiological and laparoscopic diagnosis were as follows:

- Criteria for acute appendicitis, acute cholecystitis, ovarian cyst, peritonitis and PID given in table 1.
- NSAP- NSAP was defined as an abdominal pain in right iliac or hypogastric area lasting more than 6 hours without fever, leukocytosis, or obvious peritoneal signs and uncertain diagnosis after physical examination and baseline investigations including abdominal sonography.
- Cirrhosis was identified on laparoscopy by visualizing pale shrunken liver studded with multiple small nodules and

adhesion/band by direct visualization. Liver metastases were pre operatively diagnosed by abdominal CT.

**Table 1- Showing disease with their Clinicoradiological and laparoscopic diagnostic features**

Conditions	Criteria/Findings	
	Clinico-radiological	Laparoscopic
<b>Acute Appendicitis</b>	1. Patients with MANTRELS score $\geq 7$ or 2. Patients with MANTRELS score=5-6 with USG findings suggestive of appendicitis* *thickened appendix wall, loss of compressibility, increased echogenicity of surrounding fat, pericecal fluid	1. Grossly looking inflamed appendix or 2. Vascular injection of serosa of appendix. And/ or 3. Pus, fibrin around appendix with gross inflammation visibly
<b>Acute Cholecystitis</b>	1. Pain right hypochondrium(RHC) 2. Tenderness RHC $>6$ hours 3. Murphys sign positive 4. Leucocytosis $>10000$ /cumm 5. USG showing stones with distended thick-walled GB, pericholecystic fluid.	1. Distended gall bladder(GB) And 2. Edematous wall of GB And/or 3. Adherent omentum to GB
<b>Peritonitis</b>	1. Pain abdomen 2. Diffuse abdominal tenderness and guarding 3. Fever $>100$ F 4. Leucocytosis 5. X-RAY showing gas under diaphragm	Direct visualization of pus in the peritoneal cavity
<b>PID</b>	In a female of child bearing age presence of; 1. Pain RIF/hypogastrum with or without tenderness and guarding 2. Abnormal vaginal discharge 3. Fever 4. Low back pain 5. Inter-menstrual bleeding	1. Hyperemia of tubal surface and 2. Edema of tubal wall and 3. Sticky exudates on tubal surface
<b>Ovarian Cyst</b>	USG evidence of ovarian cyst	Direct visualization of cyst

A therapeutic laparoscopy was attempted in all cases except in those with ovarian cyst, PID. In patients with a pre operative diagnosis of appendicitis who had normal appendix on laparoscopy and another pathology was found, the appendix was not removed. However, if the patients had both a normal appendix and no other pathology was found, then the appendix was removed.

During our study period, 15 patients presented with perforated peptic ulcer. All the patients were hemodynamically unstable and urgent laparotomy was done in all cases. 30 patients of abdominal trauma (blunt) were admitted in the surgical casualty. 22 of these were hemodynamically unstable and urgent laparotomy was done in all cases. 8 patients were hemodynamically stable but on ultrasonography and CECT abdomen no free fluid or visceral injury was observed and it was decided not to proceed with laparoscopy in these patients as it was too invasive a procedure for these patients.

**OBSERVATIONS AND RESULTS**

In this study, majority of the patients were in the age-group of 15-30 (n=23; 62%) with males constituted 10 (27%) patients and females constituted 27(73%) of patients (Table 2, Table 3). 4(11%) patients had hypertension; 2 (5.5%) patients had diabetes mellitus; 2 (5.5%) patients had hypothyroidism.

**Table 2-Age wise distribution of patients**

AGE GROUP	NO. OF PATIENTS	% AGE
15-30	23	62
31-45	8	22
46-60	3	8
61-75	3	8
TOTAL	37	100

**Table 3- Sex distribution of patients**

SEX	NO. OF PATIENTS	%AGE
FEMALE	27	73
MALE	10	27
TOTAL	37	100

There were 10 patients with a pre-operative diagnosis of NSAP( non-specific abdominal pain). Out of these, 5 (50%) patients had acute appendicitis on laparoscopic examination. Other diagnosis on laparoscopic inspection included; ruptured ovarian follicle in 1(10%) patient, PID in 1(10%) patient, adhesion band in 1(10%) patient. 2(20%) patients were left without a diagnosis after laparoscopic inspection (Table 4, 5).

**Table 4- Diagnosis based on clinicoradiological findings and on laparoscopy**

DIAGNOSIS	CLINICO-RADIOLOGICAL	ON LAPAROSCOPY
Acute appendicitis	15	18
Acute cholecystitis	10	10
NSAP\no diagnosis	10	2
Peritonitis	1	1
Metastasis liver	1	-
PID	-	2
Ovarian cyst	-	2
Cirrhosis liver	-	1
Adhesion band	-	1
TOTAL	37	37

**Table 5- Difference of diagnosis pre-op and post laparoscopy for NSAP and Acute Appendicitis**

Pre-op Diagnosis of	Laparoscopic Diagnosis						Total
	Acute appen dicitis	Ovari an cyst	PID	Ruptured Ovarian follicle	Adhe sion band	No diagn osis	
NSAP\No diagnosis N=10	5	-	1	1	1	2	10
Acute Appendicitis N=15	13	1	1	-	-	-	15

Out of 15 patients with a pre-operative diagnosis of acute appendicitis, only 13 patients (87%) had acute appendicitis on laparoscopic examination. In the other 2 patients, 1 patient (6.5%) had ovarian cyst and another patient (6.5%) had PID (Table 4, 5).

There were 10 patients with a pre-operative diagnosis of acute cholecystitis. In all the patients (100%) diagnosis was found to be correct on laparoscopic inspection. (Table 4, 6) Diagnosis of peritonitis in one patient was confirmed on laparoscopy, the cause being gall bladder perforation. (Table 4, 6) There was one patient with a pre-operative diagnosis of liver metastasis diagnosed on CECT abdomen which was later found to be cirrhosis of liver on laparoscopic examination and confirmed on histopathological examination. (Table 6).

**Table 6- Difference of diagnosis pre-op and post laparoscopy for Acute cholecystitis, Peritonitis and metastasis**

Pre-op Diagnosis Of	Laparoscopic Diagnosis				Total
	Acute cholecystit is	Peritonitis (GB perforatio n)	Cirrhosis liver	Peritonitis (GB perforatio n)	
Acute Cholecystitis N=10	10	-	-	-	10
Peritonitis N=1	-	-	-	1	1
Metastasis Liver N=1	-	-	1	-	1

In this study, 30 (81%) patients underwent therapeutic laparoscopic procedures (19 appendectomies; 8 cholecystectomies; 1 adhesiolysis; 1 liver biopsy; 1 cholecystostomy). 4(10.8%) patients underwent laparoscopy for diagnostic purpose only. 3(8%) patients required conversion to open procedure for managing their condition. (Table 7). There were 3 (8%) conversions; 2 because of dense adhesions and 1 because of anatomical difficulty (sub-hepatic appendix). (Table 7)

**Table 7- Laparoscopic operative procedures done and conversion required**

Operative Procedure	Laparoscopic	Converted
Appendectomy	19	1
Cholecystectomy	8	2
Laparoscopic adhesiolysis	1	-
Liver biopsy	1	-
Diagnostic only	4	-
Cholecystostomy	1	-
TOTAL	34	3

Pre-operative diagnosis was confirmed in 26 out of 37 patients (70%) in this study. The diagnosis was changed in 11(30%) of patients. Only 2(5.4%) patients were left without a diagnosis after diagnostic laparoscopy. A definitive diagnosis was made in 35 cases (94.6%) after diagnostic laparoscopy. (Table 8)

**Table 8- Confirmation and change in diagnosis after diagnostic laparoscopy**

Pre-op Diagnosis	Confirmed	% Age	Changed	% Age
Acute appendicitis	13	87	2	13
Acute cholecystitis	10	100	0	0
NSAP	2	20	8	80
Peritonitis	1	100	0	0
Liver metastasis	0	0	1	100
TOTAL	26	70	11	30

The mean operating time for laparoscopic appendectomy was 44.89±14.66 minutes, for laparoscopic cholecystectomy 137.11±43.08 minutes, for laparoscopic adhesiolysis 28 min., for lap. liver biopsy 70 min, for diagnostic purposes only 27.5±6.4 min and for cholecystostomy 170 minutes.

The mean hospital stay for laparoscopic appendectomy was 3.39±1.3 days, for laparoscopic cholecystectomy 5.2±2.8 days, for laparoscopic adhesiolysis 3 days, for laparoscopic liver biopsy 4 days, for diagnostic purposes only 2.25±0.86 days and for cholecystostomy 7 days.

The complication rate was 17% with fever developing in 3 patients, UTI in 1 patient, port-site infection in 1 patient, and basal pneumonia in 1 patient.

**DISCUSSION**

With the expansion in technology and surgical experience increasing number of patients are being managed by laparoscopy in the emergency setting. With the primary aim of laparoscopy in the emergency being diagnostic the number of patients who are being managed with definitive laparoscopic surgery has also increased. Laparoscopic surgery has been described in many abdominal emergencies, such as acute appendicitis, blunt and penetrating trauma, peritonitis, acute cholecystitis, acute small bowel obstruction and non specific abdominal pain with excellent results. Emergency diagnostic laparoscopy is, however, not without distracting arguments; missed diagnoses, procedure related complications and delay to definitive open surgical procedure are all potential negatives.

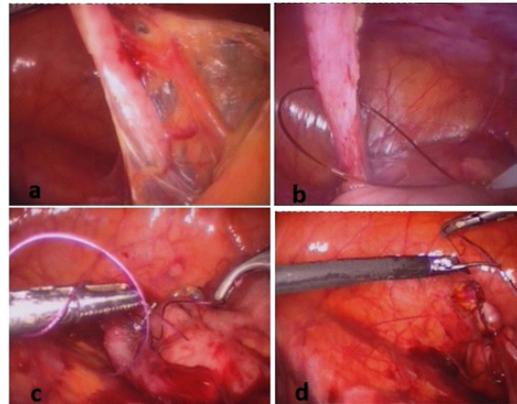
The present study was conducted on 37 patients who were admitted in the surgical --+casualty with complaints of abdominal pain. Laparoscopy was performed in these patients within 48-72 hours of admission and in whom surgical intervention was considered necessary based on clinico-radiological signs.

Golash et al<sup>7</sup> in their study had observed a similar age distribution with 799 of their 1320 patients (59%) in the age group of 15-30. Reem al bareeq et al<sup>7</sup> in their study reported a mean age of 31 yrs. in their studied patients. Similarly in a study by Scott et al<sup>8</sup> the mean age of the patients presenting with acute abdomen was 27 years. Abdul mohsen al mulhim<sup>9</sup> in his study had observed a mean age of 40 yrs for patients

with acute cholecystitis which is in concordance with our study. Larrson et al<sup>10</sup> in their study observed a mean age of 24.9 yrs. in their group of patients with suspected appendicitis which is in accordance with our results.

In this study, females accounted for majority of the patients (n=27; 73%), which is in concordance with study of Golash et al<sup>7</sup> (60%), Salky et al<sup>6</sup> (70%), Kirshtein et al<sup>11</sup> (69%) and Scott et al<sup>8</sup> (70%).

In this study, there were 15 patients with a pre-operative diagnosis of acute appendicitis. Out of these only 13 patients (87%) had acute appendicitis (Image 1) on laparoscopic examination. In the other 2 patients, 1 patient (6.5%) had ovarian cyst (Image 2) and another patient (6.5%) had PID. Our study is in concordance with that of Lim et al<sup>12</sup> who in their study reported that out of a total of 100 patients with suspected diagnosis of appendicitis, 78 (78%) had appendicitis confirmed on laparoscopy. Similarly, Scott et al<sup>8</sup> reported in their study that out of 55 patients with a clinical diagnosis of appendicitis only 44 (72%) patients had appendicitis documented on laparoscopy. The minor difference in the percentage between our study and the above studies can be explained on the basis of small sample size of our studied group.

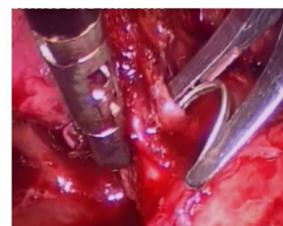


**Image 1- Laparoscopic view of inflamed appendix and appendectomy**



**Image 2- Ovarian Cyst on Laparoscopic Inspection**

There were 10 patients with a pre-operative diagnosis of acute cholecystitis. In all the patients (100%) diagnosis was found to be correct on laparoscopic inspection (Image 3). Oliver Warren et al<sup>13</sup> reported that there is little role of laparoscopy in the diagnosis of acute cholecystitis which also relates to our study. Trowbridge et al<sup>14</sup> reported that diagnosis of acute cholecystitis can be done with near 100% specificity from a combination of clinical features, USG findings, and WBC count greater than 10,000/mm which also corresponds to our study. Chung et al<sup>15</sup> reported in their study that pre-operative diagnosis was most accurate in acute cholecystitis; 8 out of 8 cases (100%) in their study on the role of laparoscopy in acute abdomen.



**Image 3- Calot's Triangle in Acutely Inflamed Gallbladder**

There were 10 patients with a pre-operative diagnosis of NSAP (non-specific abdominal pain). Out of these, 5 (50%) patients had acute appendicitis on laparoscopic examination. Other diagnosis on laparoscopic inspection included; ruptured ovarian follicle (Image 4) in 1(10%) patient, PID in 1(10%) patient, adhesion band in 1(10%) patient. 2(20%) patients were left without a diagnosis after laparoscopic inspection.



**Image 4- Ruptured Ovarian Follicle**

Kirshstein et al<sup>11</sup> reported in their study that out of a total of 129 patients with obscure abdominal pain 61 (47%) had appendicitis which closely resembles the figures in our group of patients. Reem al-bareeq et al<sup>7</sup> similarly reported in their study on patients with NSAP that 73% had appendicitis, 14% had PID, 7% had ovarian cyst. This is in accordance with our study in which 10% had ovarian cyst and 10% had PID.

In our study, there was one patient with a pre-operative diagnosis of peritonitis which was confirmed on laparoscopy, the cause being gall bladder perforation. The said patient presented to us with pain right hypochondriac region with signs of localized peritonitis and leucocytosis with USG being un-remarkable. Laparoscopy revealed gall bladder perforation with biliary peritonitis. Thorough peritoneal washes were given and laparoscopic cholecystectomy was done. The patient recovered well.

In this study, there was one patient with a pre-operative diagnosis of liver metastasis diagnosed on CECT abdomen which was later found to be cirrhosis of liver on laparoscopic examination and confirmed on histopathological examination. The said patient presented to us with pain right hypochondriac region. The previous upper and lower GI endoscopy (done a month back for non-specific GI symptoms) was unremarkable. CECT abdomen revealed liver metastasis which was contradicted on laparoscopy which revealed cirrhosis of liver and confirmed on histopathological examination.

In this study, 30 (81%) patients underwent therapeutic laparoscopic procedures (19 appendectomies; 8 cholecystectomies; 1 adhesiolysis; 1 liver biopsy; 1 cholecystostomy, 4(10.8%) patients underwent laparoscopy for diagnostic purpose only. 3(8%) patients required conversion to open procedure for managing their condition.

Golash et al<sup>2</sup> in their study reported that 1073 patients out of 1320 (83%) who had undergone laparoscopy for acute abdominal conditions underwent a laparoscopic operation to manage their condition and 7% required conversion to an open procedure. Our results were similar to their study results. Kirshstein et al<sup>11</sup> reported in their study that in 75% of their patients a therapeutic laparoscopic procedure was performed. Our results are also similar to those obtained by Reem al-bareeq et al<sup>7</sup> in whose study 78 out of 100 patients (78%) underwent a therapeutic procedure to manage their condition by laparoscopy. Edvaldo fahel et al<sup>16</sup> observed a conversion rate of 6.6% in their group of patients which was almost equivalent to our conversion rate of 8%. Suter et al<sup>17</sup> reported a conversion rate of 15.6% for laparoscopic cholecystectomy in acute cholecystitis. In our study the conversion rate for laparoscopic cholecystectomy was 20% which closely resembles the study of Suter et al.

In this study, the pre-operative diagnosis was confirmed in 26 out of 37 patients (70%). The diagnosis was changed in 11(30%) of patients. Only 2 (5.4%) patients were left without a diagnosis after diagnostic laparoscopy. A definitive diagnosis was made in 35 cases (94.6%) after diagnostic laparoscopy.

Golash et al<sup>2</sup> reported a definitive diagnosis rate of 90% after diagnostic laparoscopy and change in diagnosis in 30% of cases, which was also observed in our study. Similarly, Salky et al<sup>6</sup> reported that in

their group of 121 patients with acute abdominal pain, a definitive diagnosis was made in 119 cases (98%) by laparoscopy. Kirshstein et al<sup>11</sup> in their study observed that laparoscopy done for abdominal emergencies obtained a correct diagnosis in 98.6% of the cases. Chung et al<sup>15</sup> observed in their study that the preoperative diagnosis was confirmed by laparoscopy ~80% of cases. The results of the above studies closely correspond to our observations.

In this study, the mean operating time for laparoscopic appendectomy was 44.89±14.66 minutes, for laparoscopic cholecystectomy 137.11±43.08 minutes, for laparoscopic adhesiolysis 28 minutes, for laparoscopic liver biopsy 70 minutes, for diagnostic purposes only 27.5±6.4 minutes and for cholecystostomy 170 minutes.

Chung et al<sup>15</sup> reported a similar operating time for laparoscopic acute appendectomy (42 ± 18 minutes; n 12). Kehagias et al<sup>18</sup> in their study reported a mean operating time of 44.3 ± 24 minutes for laparoscopic appendectomy done in cases of acute appendicitis which closely resembles the operating time in our group of patients.

A study of the literature reveals operating times ranging from 100-150 minutes in cases of laparoscopic cholecystectomies done in acute cholecystitis.

Pessaux et al<sup>19</sup> in their study found out a mean length of surgery of 150.3 minutes. Cox et al<sup>20</sup> in their study reported a median operation time for successful laparoscopic cholecystectomy for acute inflammation to be 105 minutes. Abdul Mohsen et al<sup>9</sup> reported the mean operating time to be between 105 and 126 minutes. In our study the mean operating time for laparoscopic cholecystectomy was 137.11 minutes which falls in the range of above studies.

In this study, the mean hospital stay for laparoscopic appendectomy was 3.39±1.3 days, for laparoscopic cholecystectomy 5.2±2.8 days, for laparoscopic adhesiolysis 3 days, for laparoscopic liver biopsy 4 days, for diagnostic purposes only 2.25±0.86 days and for cholecystostomy 7 days.

Swank et al<sup>21</sup> in their study reported a mean hospital stay of 3 days in patients who had undergone laparoscopic acute appendectomy which is similar to our study. Similarly, Chung et al<sup>15</sup> in their study reported a mean hospital stay of 3.5±0.3 in the patients undergoing laparoscopic appendectomy. Similar results were observed by Yong et al<sup>22</sup> who reported a median hospital stay 3.0 days in their patients undergoing laparoscopic appendectomy.

Like in above studies, our study also found out the mean hospital stay of patients undergoing laparoscopic appendectomy to be 3.39 days.

Abdul Mohsen et al<sup>9</sup> reported mean hospital stay of 5 days in their patients who had undergone laparoscopic cholecystectomy for acute cholecystitis. In our study also the mean hospital stay of patients undergoing laparoscopic cholecystectomy was 5.2 days

In this study, the complication rate was 17% with fever developing in 3 patients, UTI in 1 patient, port-site infection in 1 patient, and basal pneumonia in 1 patient. Chung et al<sup>15</sup> in their study reported that out of 34 who had undergone laparoscopic procedures exclusively 6 developed complications (17.6%). In our study also complication rate was 17%.

## CONCLUSION

The advantages offered by the use of laparoscopy in the surgical emergencies include;

1. Confirmation of the clinical diagnosis with minimal surgical trauma to the abdominal wall.
2. Preventing un-necessary laparotomies.
3. Therapeutic benefit to the patient in the same sitting when required.
4. Solving the diagnostic dilemma of NSAP.
5. Minimal incidence of complications.

However, use of laparoscopy in the emergencies has certain limitations, e.g. cannot be performed in hemo-dynamically unstable patients.

We conclude that routine laparoscopy for the acute abdomen is safe

and accurate. In addition to establishing a clear diagnosis, the use of laparoscopy also confers important therapeutic benefits. A laparoscopic unit which is completely dedicated to undertake laparoscopic procedure during day and night in various abdominal emergencies will greatly enhance the efficacy and applicability of laparoscopy and will extend the benefits of this technology to a large sub-set of patients which will be cost-effective in the long run and will save a lot of money to the exchequer.

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