



1. A to Z of Laparoscopic Surgery in Abdominal Trauma

- Minimal invasive surgery in trauma
- A solution for Concerns of therapeutic trauma laparoscopy - Laparoscopic-assisted surgery -
- Pitfalls and Troubleshooting in Trauma Laparoscopy

Minimal invasive surgery in trauma

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Minimally invasive surgery(MIS) is now widely used in all surgical field except for trauma surgery. This is because MIS have several disadvantage including increased possibility of missed injury & bowel injury, increased IICP, more time consuming, greater chance of gas embolism. If missed injuries were occurred or time to bleeding control is delayed, the patient's survival was threatened. However,MIS have extinguished benefits including improved cosmesis, low tissue desiccation, lower chance of post-operative paralytic ileus and so on.

Laparoscopic trauma surgery(LTS) is divided into two classes, diagnostic & therapeutic.

Diagnostic laparoscopy

Diagnostic laparoscopy is used for sparing non therapeutic laparotomy. Especially in cases with abdominal stab wound with proven or equivocal penetration of fascia, suspected intraabdominal injury after blunt trauma, diagnosis of diaphragmatic injury from penetrating trauma to the thoracoabdominal area. Sensitivity, specificity, diagnostic accuracy of diagnostic laparoscopy range from 75% to 100%.

Therapeutic laparoscopy

Laparoscopic repairs of injuries to every organ have been described. Injuries to diaphragm, parenchyma organ and gastro-intestinal tract have been successfully repaired laparoscopically. Patients who continue to bleed following embolization can be treated with laparoscopy by topical hemostatic agent or even splenectomy. Small laceration of stomach, duodenum, small bowel, colon can be repaired laparoscopically. Sometimes an anastomosis or a long repair are usually performed extracorporeally through a small focused celiotomy. Diaphragmatic hernia(esp. Lt.) can be repaired successfully by various laparoscopic suture techniques.

Contraindication

Hemodynamic instability is currently the absolute contraindication for laparoscopy. Concomitant severe traumatic brain injury also exclude laparoscopy because of increased intracranial pressure

Conclusion

Position of laparoscopic surgery in trauma field is between laparotomy and observation. Because of innovative development

of laparoscopic instruments, almost all surgery can be conducted by laparoscopic method. Role of laparoscopy in trauma will be increased also in trauma surgery. If the patient's vital sign is stable, laparoscopic methods can be applied, however we should be careful about missed injury.

A solution for Concerns of therapeutic trauma laparoscopy - Laparoscopic-assisted surgery -

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DISCLOSURE

✓ NO CONFLICTS OF INTEREST!

OUTLINE

1. Rationale for use of laparoscopy in trauma
2. Limitation of therapeutic laparoscopy
3. Definition and range of laparoscopic-assisted surgery
4. DKUH experience
5. Conclusion



TRAUMA LAPAROSCOPY

➤ The minimally invasive procedure

→ Attractive alternative for many traumatologists

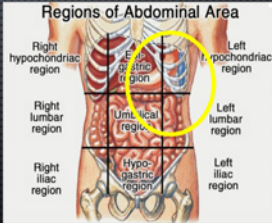
- Potentially quicker postoperative recovery
- Simplified wound care
- Reducing the morbidity associated with negative laparotomies.



TRAUMA LAPAROSCOPY

➤ General indication

- I. Hemodynamically stable patients with penetrating injuries
- II. Full thickness abdominal wall penetration
- III. Hollow viscus injury
- IV. Left thoracoabdominal trauma
 - High probability of diaphragm injury



Regions of Abdominal Area

Right hypochondriac region, Left hypochondriac region, Right lumbar region, Left lumbar region, Right iliac region, Left iliac region, Umbilical region

CLINICAL MANAGEMENT UPDATE

Practice Management Guidelines for Selective Nonoperative Management of Penetrating Abdominal Trauma

John J. Coons, MD, FRCR; Babbar, MD, William C. Chiu, MD, Therese M. Duane, MD, Michele R. Holcomb, MD, Margaret A. Tandoh, MD, Rao R. Ivatury, MD, and Thomas M. Scalea, MD

J Trauma. 2010 Mar;68(3):721-33

❖ EAST guidelines

- Diagnostic laparoscopy may be considered as a tool to evaluate diaphragmatic lacerations and peritoneal penetration (level 2).
 - ✓ Mortality from the delayed recognition of incarcerated diaphragmatic injury after a SW to left thoracoabdominal area was 36%

EAES consensus statement

Surg Endosc (2006) 20: 14–29
DOI: 10.1007/s00464-005-0564-0

Surg Endosc 2012 Aug;26(8):2134-64

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Laparoscopy for acute abdomen

Evidence-based guidelines for Laparoscopic approach to acute abdomen from the Consensus Development Conference of the Società Italiana di Chirurgia Endoscopica e nuove tecnologie (SICE), Associazione Chirurghi Ospedalieri Italiani (ACOI), Società Italiana di Chirurgia (SIC), Società Italiana di Chirurgia d'Urgenza e del Trauma (SICUT), Società Italiana di Chirurgia nell'Ospedalità Privata (SICOP), and the European Association for Endoscopic Surgery (EAES)

Ferdinando Agresta · Luca Avaslani · Gian Luca Baiocchi · Carlo Bergamini · Fabio Cesare Campanile · Michele Carlucci · Gianfranco Coccorullo · Alessio Corradi · Roberto Franzato · Massimo Lupo · Vincenzo Mandala · Antonino Mirabella · Graziano Pernazza · Micaela Piccoli · Carlo Staudacher · Nereo Vettoretto · Mauro Zago · Emanuele Lettieri · Anna Levati · Domenico Pietrini · Mariano Scaglione · Salvatore De Masi · Giuseppe De Placido · Marsilio Francesci · Monica Rasl · Abe Fingerhut · Schman Uzunis · Silvio Garattini

LAPAROSCOPY FOR ABDOMINAL TRAUMA

- ❖ After penetrating trauma of the abdomen, laparoscopy may be useful in hemodynamically stable patients with documented or equivocal penetration of the anterior fascia (GoR B).
- ❖ Laparoscopy should be considered in hemodynamically stable blunt trauma patients with suspected intraabdominal injury and equivocal findings on imaging studies or even in patients with negative studies but with a high clinical likelihood for intra-abdominal injury ("unclear abdomen") to exclude relevant injury (GoR C).

Surg Endosc. 2012 Aug;26(8):2134-64.

TRAUMA LAPAROSCOPY

➤ Blunt trauma

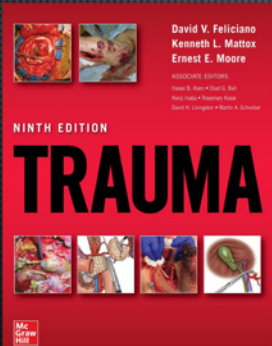
- Less evidence than penetrating trauma

TRAUMA LAPAROSCOPY

✓ LAPAROSCOPY FOR TRAUMA?

LAPAROSCOPIC EVALUATION AND TREATMENT

The role of diagnostic laparoscopy for possible abdominal trauma has been controversial since its introduction to modern surgical practice. It has been considered by some to be helpful in avoiding laparotomy in hemodynamically stable patients with possible penetrating thoracoabdominal trauma and a suspected diaphragmatic injury.¹⁰ With improved techniques and capabilities, many diaphragmatic tears and even gastric perforations may be repaired using laparoscopic techniques. Indications for diagnostic laparoscopy are less certain for patients with suspected blunt intestinal trauma. Early reports demonstrate an excessively high rate of missed injuries.¹¹ Because laparoscopic training and skills have markedly improved over time, it is possible that laparoscopic evaluation of a very select subset of patients, such as those with free fluid and worsening abdominal pain, but not frank peritonitis, may be an option.



THERAPEUTIC LAPAROSCOPY- SYSTEMATIC REVIEW

Tab. 1. Ergebnisse Studien und relevante Parameter und statistische Zusammenfassung

Publikation	Studienlage	Patienten	Trauma	Operative Konversionsrate, % (n/N)	Konversionsrate, % (n/N)	Stratifikationsmerkmale, Anzahl Konversionen, % (n/N)	Prozeduren, Anzahl Konversionen, % (n/N)	Notwendigkeiten	Land
Mattarich et al. (20)	Retrospektiv	137	BAF	0/137 (0)	4/137 (3%)	Aszendend, Transversal, Jejunum, Ileum, Blinddarm, Colon sigmoideum, Colon descendens, Jejunum, Ileum, Blinddarm, Colon sigmoideum, Colon descendens	10/137 (8%)	Laparoskopie (71%) und Laparotomie assistierte (29%) Operationen	Italien
Klein et al. (21)	Prospektiv, retrospektiv	23	BAF	0/23 (0)	0/23 (0)	S.A.	S.A.	Laparoskopie assistierte Operationen, Bauchdrainage systeme, offene laparoskopische Exploration	Italien
Hughes et al. (22)	Systematisches Review	1024	BAF	2/1024 (0.2%)	442/1024 (43%)	S.A.	S.A.	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	USA
Mattarich et al. (23)	Retrospektiv	39	BAF	0/39 (0)	0/39 (0)	25/39 (64%)	25/39 (64%)	Laparoskopie assistierte Operationen, Bauchdrainage systeme, offene laparoskopische Exploration	Italien
Klein et al. (24)	Retrospektiv	114	BAF	0/114 (0)	0/114 (0)	62/108 (58%)	62/108 (58%)	Laparoskopie assistierte Operationen, Bauchdrainage systeme, offene laparoskopische Exploration	Italien
Waller et al. (25)	Systematisches Review	2569	BAF	83/2569 (3.2%)	1072/2569 (41.8%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	1072/2569 (41.8%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	USA
Hughes et al. (26)	Prospektiv, retrospektiv	15	BAF	0/15 (0)	1/15 (7%)	15/14 (86%)	15/14 (86%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	USA
Klein et al. (27)	Retrospektiv	56	BAF	0/56 (0)	10/56 (18%)	10/56 (18%)	10/56 (18%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	Italien
Cohen et al. (28)	Retrospektiv	146	BAF	0/146 (0)	76/146 (52%)	64/76 (86%)	64/76 (86%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	USA
Klein et al. (29)	Retrospektiv	15	BAF	0/15 (0)	0/15 (0)	10/17 (59%)	10/17 (59%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	Italien
Klein et al. (30)	Retrospektiv	17	BAF	0/17 (0)	2/17 (12%)	4/17 (24%)	4/17 (24%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	Italien
Zhou et al. (31)	Prospektiv, retrospektiv	25	BAF	0/25 (0)	1/25 (4%)	16/24 (67%)	16/24 (67%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	China
Nicolaie (32)	Systematisches Review	847	BAF	0/847 (0)	313/847 (37%)	S.A.	S.A.	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	USA
Mattarich et al. (33)	Retrospektiv	316	BAF	0/316 (0)	41/316 (13%)	102/316 (32%)	102/316 (32%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	Italien
Mattarich et al. (34)	Retrospektiv	99	BAF	0/99 (0)	10/99 (10%)	102/316 (32%)	102/316 (32%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	Italien
Mattarich et al. (35)	Retrospektiv	385	BAF	0/385 (0)	130/385 (34%)	372/385 (97%)	372/385 (97%)	Beschreibung der Studien, Ergebnisse, Limitationen, Qualität	Italien

Chirurg. 2020 Jul 9;117(567-574)

- Therapeutic laparoscopy rate: 60.5%
 - Blunt: 67.9%
 - Penetrating: 58.8%
- Open conversion rate: 29.3%
 - Blunt: 14.1%
 - Penetrating: 30.9%
- Missed injury: 1.4%
 - Blunt: 0%
 - Penetrating: 1.6%
- Complication rate: 8.6%
 - Blunt: 7.5%
 - Penetrating: 8.9%

LIMITATIONS

- ❖ Rate of therapeutic laparoscopies is relatively low
- ❖ Narrow therapeutic range of laparoscopy in trauma

- ✓ Surgeon factor
 - Patient
 - Indomitable

- ❖ Lack of advanced laparoscopic skills or surgeon expertise
- ❖ Lack of laparoscopic training program
- ❖ Institutional resources
- ❖ Uncertain in bleeding or multiple injuries
- ❖ Prolonged operation

LAPAROSCOPIC-ASSISTED SURGERY (LAS)

Definition

- Laparoscopic focusing of the injury and extracorporeal resection or repair performed with an additional laparotomy incision (≤10 cm long) [JTI. 2021 Mar 15, Epub]
- Maintains the positive minimally invasive attributes of laparoscopic surgery but may reduce the complexity of certain procedures by allowing challenging maneuvers to be performed outside the peritoneal cavity [Vet Clin North Am Small Anim Pract. 2016 Jan;46(1):45-61]



Lin et al. World Journal of Emergency Surgery (2015) 10:16
DOI: 10.1186/s12877-015-0002-z

WORLD JOURNAL OF EMERGENCY SURGERY

RESEARCH ARTICLE Open Access

Laparoscopic surgery in abdominal trauma: a comparison by outcomes

Table 3 Operative procedures in patients undergoing laparoscopic surgery

Operative procedures	Patients (%)	Open (n=55)	Laparoscopic (n=41)	p-value	
Simple closure (suture, endo-GIA)	31 (75.6)	57.2 ± 15.6	53.8 ± 15.7	0.296	
Bleeding control (suture, Ligasure™)	13 (31.7)	9.07 ± 2.8	9.32 ± 3.6	0.708	
Irrigation & drainage (liver, spleen, pancreas)	11 (26.8)	3.16 ± 0.9	3.17 ± 1.4	0.977	
Examination only (stab injury)	4 (9.8)	35 (64%)	23 (56%)	0.529	
Loop colostomy	1 (2.4)				
Laparotomy assisted (mini laparotomy)	10 (24.4)	97.2 ± 31.0	91.2 ± 34.6	0.374	
Segmental resection of small bowel	10 (24.4)	2.98 ± 0.9	2.44 ± 0.9	0.006	
Open laparotomy	55 (100)	Hospital stay (day)	17.58 ± 12.7	11.5 ± 5.3	0.004
Simple closure (suture)	25 (45.5)	Complications			
Bleeding control	18 (32.7)	Wound infection	5	0	0.000
Segmental resection of small bowel	11 (20.0)	Postoperative abscess	0	0	
Loop colostomy	1 (1.8)	Mortality	0	0	

JTI ORIGINAL ARTICLE

Journal of Trauma and Injury

	Total laparoscopic surgery (n=12)	Laparotomy-assisted surgery (n=8)	Open conversion (n=3)	p-value
Age (years)	51.0 (43.75-61.0)	38.5 (30.5-44.75)	52.0 (37.5-58.5)	0.547
Sex				0.817
Male	8 (66.7)	6 (75.0)	3 (100)	
Female	4 (33.3)	2 (25.0)	0	
BMI	24.10 (21.53-26.36)	21.51 (20.89-25.10)	24.06 (22.06-25.70)	0.663
ISS	11.0 (4.0-18.0)	11.50 (6.0-22.0)	8.0 (6.0-12.0)	0.545
SBP (mmHg)	134.50 (105.25-139.0)	118.50 (114.75-133.0)	152.0 (148.50-154.50)	0.173
pH	7.38 (7.36-7.43)	7.41 (7.36-7.43)	7.41 (7.32-7.41)	0.739
Base excess	-1.50 (-4.52 to -0.70)	-0.15 (-1.95 to 0.60)	-0.90 (-8.65 to -0.60)	0.342
Lactate (g/dL)	2.55 (1.75-3.92)	1.85 (1.27-3.25)	1.40 (1.20-6.70)	0.773
SOFA score	0.0 (0-1.5)	1.0 (0.0-2.5)	3.0 (1.5-6.5)	0.405
Operation time (min)	145.0 (103.25-179.75)	167.50 (141.25-198.75)	210.0 (180.0-210.0)	0.450
EBL (mL)	75.0 (20.0-187.50)	200.0 (87.50-372.50)	1500.0 (1000.0-1750.0)	0.081
Hospital stay (day)	11.0 (5.0-22.25)	9.50 (6.0-13.0)	12.0 (8.50-26.50)	0.847
RBC transfusion (unit)	0 (0-0.25)	1.0 (0.0-4.50)	2.0 (1.0-4.0)	0.485
Postoperative diet (day)	3.0 (2.0-3.25)	4.50 (3.75-5.50)	3.0 (3.0-5.0)	0.039
Drain removal (day)	3.50 (0-6.0)	4.50 (4.0-5.25)	9.0 (7.0-11.0)	0.115
Morbidity	2 (16.7)	1 (12.5)	2 (66.7)	0.208
Mortality	0	0	0	-

International Journal of Surgery

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journal homepage: www.elsevier.com/locate/ijso

Original Research

Laparotomy-assisted solution for multiple bowel injuries and performed procedures.

Oleh Yevhenovych Masevych, Modeste Zacharia Koto, MBC

Bowel injuries and procedures	FTL	LAA	Total	p-value
Colon injuries	17 (47%)	19 (53%)	36 (100%)	<0.001
Grade 2	10	7	17	0.31
Grade 3	7	12	19	
Mobilized (no injuries)	1	1	2	1.00
Repair	9	12	21	0.73
Resection/anastomosis	0	5	5	0.05
Stoma	8	2	12	0.03
Small Bowel injuries	8 (15%)	47 (85%)	55 (100%)	<0.001
Grade 1	0	2	2	
Grade 2	5	7	12	
Grade 3	3	34	37	0.09
Grade 4	0	3	3	
Grade 5	0	1	1	
Repair	8	29	36	0.04
Resection/anastomosis	0	18	18	0.04

MESENTERIC LACERATION

TOTALLY LAPAROSCOPIC SMALL BOWEL RESECTION

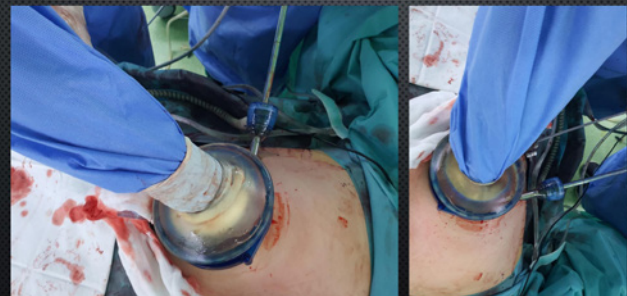
LAPAROSCOPIC-ASSISTED SMALL BOWEL RESECTION

LAPAROSCOPIC-ASSISTED DUODENAL REPAIR

LAPAROSCOPIC-ASSISTED ILEOCECECTOMY

HAND-ASSISTED LAPAROSCOPIC SURGERY (HALS)

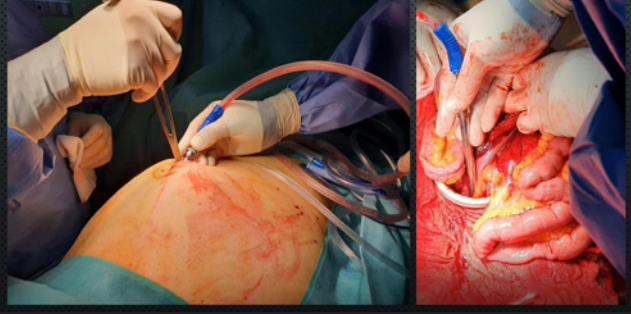
- ✓ Not suitable for trauma laparoscopy!!!
- ✓ Poor visibility



Dong Hyun Kim, Dankook University Hospital, 2021

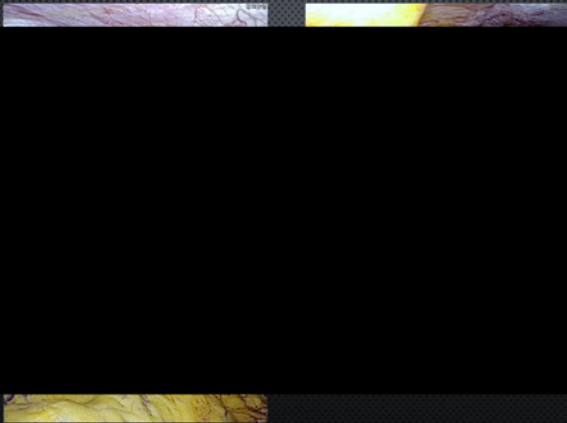
MANAGEMENT OF SPILLAGE OF LARGE-SIZED PARTICULATES

✓ Complete evacuation by direct insertion of a suction tube through a 12-mm port or mini-laparotomy



EXCEPTION OF LAPAROSCOPIC-ASSISTED SURGERY

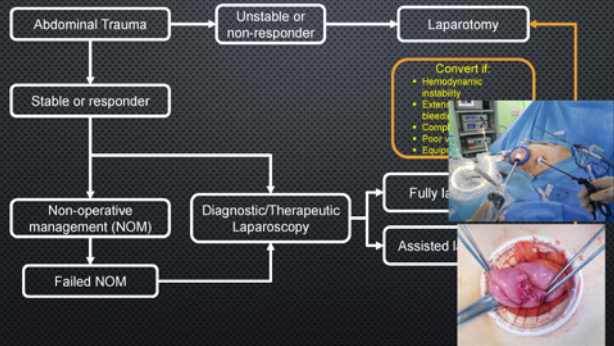
TRAUMATIC DIAPHRAGMATIC HERNIA



TRAUMATIC FLANK HERNIA

BLADDER RUPTURE

ALGORITHM OF TRAUMA LAPAROSCOPY



• Lee PC, et al. *Surg Innov*. 2014 Apr;21(2):155-65
 • Koto MZ, et al. *J Laparosc Endosc Adv Surg Tech A*. 2015 Sep;25(9):730-6
 • Matveyev D, et al. *Surg Endosc*. 2018;32(3):1344-1352
 • Bain K, et al. *Surg Endosc*. 2019 May;33(5):1618-1625

TAKE HOME MESSAGE

- ❖ Laparoscopy used safely in **hemodynamically stable patients** and can be therapeutic in patients with **selected injuries**.
- ❖ **Laparoscopic-assisted surgeries** can be an excellent alternative to open laparotomy for certain therapeutic interventions
- ❖ **Procedure-specific morbidities and patient selection** should be considered when choosing between laparoscopic-assisted and open approaches



Thank you for your attention!

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**LESS
PAIN**
More Gains
MINIMALLY INVASIVE SURGERY



Pitfalls and Troubleshooting in Trauma Laparoscopy

임경훈

경북대학교병원 권역외상센터 외과

외과 수술에서의 복강경의 적용의 효용성 및 장점에 대한 것은 더 이상 말할 필요가 없을 정도로 많은 데이터로 입증되어 있다. 그러나 외상 환자에서의 적용은 아직 많지 않은 상태이다. 그 이유는 여러가지가 있겠지만 집도자의 의도가 가장 중요할 것이므로 이번 세션을 준비하면서 대한외상학회 회원을 대상으로 복부 외상 환자 수술에서 복강경 사용에 대한 인식 및 현황에 대하여 설문조사를 먼저 시행하였다. 혈액학적으로 안정된 복부 외상 환자의 복강경 수술에 대하여 약 84%의 회원이 찬성을 하였으며, 75%의 회원이 외상 환자의 복강경 수술의 경험이 있다고 하였다. 하지만 전체 복부 외상 수술 중 복강경 수술의 비율은 대부분 10% 미만이라고 답하였다. 이렇게 복강경 수술을 하는데 주저하게 하는 가장 큰 이유는 missed injury에 대한 두려움이 가장 많았다. 이 외에 회원들께서 복강경 수술 시에 어려웠던 점과 이번 세션에서 다루었으면 하는 사항들의 종합하여 짧은 강의시간이지만 복강경을 하시는 회원들에게 최대한 도움이 될 수 있도록 강의를 준비하였다.

짧은 저의 경험이지만 8년 간 171례의 복부 외상 환자의 복강경 수술의 경험을 바탕으로 외상 환자의 복강경 수술 시 유의할 점과 몇가지 노하우를 정리 하였으므로 많은 회원들에게 도움이 되었으면 좋겠고, 이를 토대로 외상 환자의 복강경 수술 적용이 확대 되기를 바란다.



2. Worst Memories into Best Lessons

- Case #1
- Worst Memories into Best Lessons
- Coronary Artery Injury -
- Worst Memories into Best Lessons

Case #1

Gil Jae Lee

Gachon Univ.

Worst Memories into Best Lessons - Coronary Artery Injury -

KyuHyouck Kyoung

Dept. of Trauma Surgery / Trauma Center Ulsan Univ. Hospital
Univ. of Ulsan College of Medicine

BACKGROUND

- ✓ Trauma is the leading cause of death about 59% of all deaths < 45y
- ✓ Mortality: Head injury > Abdominal injury > Thoracic injury
- ✓ Blunt thoracic injury causes 25% of blunt traumatic fatalities

Injury.2017;48(1):5-12

BACKGROUND

Chest injuries	No	Percent
Rib Fracture	95	86.4%
> 3 Ribs	68	61.8%
bilateral	25	22.7%
flail chest	7	6.4%
Pneumothorax	65	59.1%
Pulmonary contusion	55	50.0%
Hemothorax	24	21.8%
Clavicle	20	18.9%
Sternal fracture	17	15.5%
Scapula	14	12.7%
Cardiac contusions	11	10.0%
Ruptured diaphragms	2	1.8%
Ruptured aortas	1	0.9%
Tracheobronchial injury	1	0.9%

Scand J Trauma Resusc Emerg Med. 2017;25(1):42

CASE 1

- ✓ 남/34세
- ✓ 사고일: 2017.02.
- ✓ 출동 요청: 시내 병원, '혈압 및 호흡 유지 되지 않는다'
- ✓ 사고 기전
운전자 교통사고
운전 중 심근경색 발생하며 사고 발생한 것으로 추정
첫 병원으로 이송 중, 이송 후 CPR 및 DC shock 2회 시행

CASE 1


CASE 1

✓ MTU 이송 중 경과



- 산소 포화도 85% 넘지 못함
- 심폐소생술 및 에피네프린 투여 대비
- 본원 심장내과 팀 대기 요청
- 심정지 재발 없이 이송 완료


✓ 응급실 도착

- ABGA: 7.26 - 59 - 41 - 86% - 5.7
- CBC: 16130 - 15.4 - 400K
- Troponin-I/CK-MB: 1.84/28.50



CASE 1



CASE 1

환자번호 199070		성명 남		울산대학교병원	
환자명 김대우		나이 54		Echocardiography	
진료과 심내과		진료과 심내과		검사진 Echo Cardiography/Heart (심장) on 2017-02-23	
Height	174 cm	Weight	74 kg	Rhythm	Normal
BSA	1.97 m ²	B.P.	110/70 mmHg	Echo Window	Good

Left Ventricle					
LVVol	33 ml	LVVol	26 ml	EDV	52 ml
LVVol	13 ml	LVVol	9 ml	LVEF	20 %
LVVol	11 ml	RVVol	18 ml	FS	3
LA diam	39 mm	LA diam	27 mm	LA diam	24 mm


CONCLUSION:

1. Normal size of LV and LA with thickened LV wall
2. Akinesis without thinning of LV apex, mild infarction with severe LV systolic dysfunction
3. Normal valvular shape and action without significant stenosis/regurgitation
4. No evidence of intracardiac mass or pericardial effusion
5. No evidence of mitral aortic insufficiency
6. RV free wall hypokinesia with RV dysfunction
7. Indeterminate LV diastolic dysfunction due to T2

EXPLANATION:

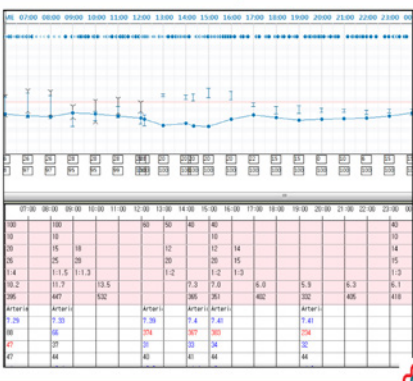
1. Ischemic insult of LAD territory with severe LV systolic dysfunction
2. RV dysfunction
3. Conduction remodeling
4. Indeterminate LV diastolic dysfunction due to E/A elevation


1. Ischemic insult of LAD territory with severe LV systolic dysfunction
2. RV dysfunction



CASE 1

HD #2






CASE 1

✓ 진단

- Lung contusion with aspiration
- Liver contusion
- Acute myocardial infarct
- ISS 13


✓ 치료 과정 및 결과

- 본원 도착 65분만에 PCI 완료
- 심부전, 호흡부전으로 5일간 ECMO 치료
- ICU 기간: 13일, 재원기간: 23일
- 퇴원 후 외래 치료 중




CASE 2

- ✓ 여/68세
- ✓ 사고일: 2020.09.
- ✓ 출동 요청: 소방 구급대, '혈압 70mmHg, SaO₂ 90% 정도이다'
- ✓ 사고 기전
 - 운전자 교통사고
 - 운전대에 가슴을 부딪침

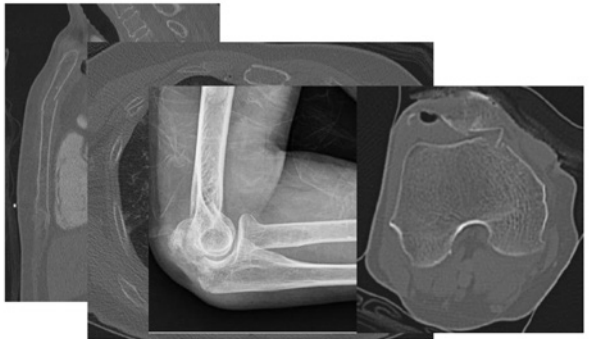



CASE 2

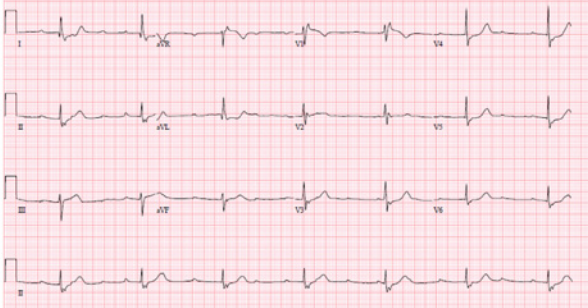

- ✓ MTU 이송 중 경과
 - 의식 명료, 혈압 70mmHg, 심박수 45bpm, SaO₂ 100% (O₂ 공급)
 - 흉벽 압통, 호흡 곤란 호소
- ✓ 응급실 도착
 - ABGA: 7.46 - 96 - 38 - 98% - 1.8
 - CBC: 21020 - 12.0 - 227K
 - Troponin-T/CK-MB: 0.561/5.30



CASE 2





CASE 2

CASE 2

- ✓ 진단
 - Multiple rib fx. & Sternal fx.
 - Pneumothorax & Lung contusion
 - Patella & Femur open fx. Rt.
 - Medial malleolar fx. Rt.
 - Olecranon fx. Rt.
 - Complete AV block
 - ISS 18



CASE 2

치술전 진단명 (Pre procedure Diagnosis)
Complete AV block

치술후 진단명 (Post procedure Diagnosis)
Complete AV block, 1 VD, RCACTO

치술일자: 2020-09-18

치술명(Procedure Name)
CAG+Temporary pacemaker insertion


Operator
Nurse
Biopsy: 胃 OLI, O

Time of Op: 19 시 10 분 / 18 시 40 분

치술관찰소견 (findings)
CAG0209 S
LM normal
LAD diffuse
LCC normal
RCA total occlusion at pRCA
*Contrast up to superior PIVM

Conclusion) CAG, 1 VD, RCACTO
Temporary pacemaker insertion was done.

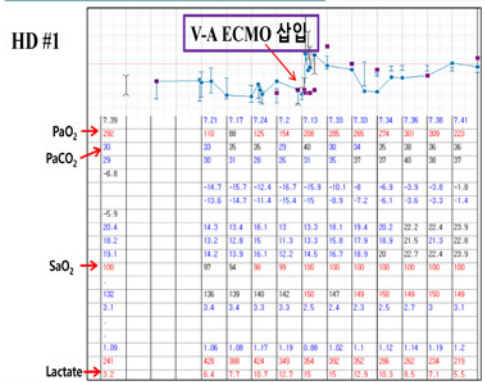
치술장차 (Procedure)
Puncture site: RF LF RR LR
RT Radial CAG & temporary pacemaker insertion was done via LT femoral vein.




CASE 2

HD #1

V-A ECMO 삽입



Time	PaO ₂	PaCO ₂	SaO ₂	Lactate
7:20	242	29	100	1.06
7:21	190	30	100	1.06
7:22	185	35	100	1.06
7:23	185	35	100	1.06
7:24	185	35	100	1.06
7:25	185	35	100	1.06
7:26	185	35	100	1.06
7:27	185	35	100	1.06
7:28	185	35	100	1.06
7:29	185	35	100	1.06
7:30	185	35	100	1.06
7:31	185	35	100	1.06
7:32	185	35	100	1.06
7:33	185	35	100	1.06
7:34	185	35	100	1.06
7:35	185	35	100	1.06
7:36	185	35	100	1.06
7:37	185	35	100	1.06
7:38	185	35	100	1.06
7:39	185	35	100	1.06
7:40	185	35	100	1.06
7:41	185	35	100	1.06
7:42	185	35	100	1.06
7:43	185	35	100	1.06
7:44	185	35	100	1.06
7:45	185	35	100	1.06
7:46	185	35	100	1.06
7:47	185	35	100	1.06
7:48	185	35	100	1.06
7:49	185	35	100	1.06
7:50	185	35	100	1.06
7:51	185	35	100	1.06
7:52	185	35	100	1.06
7:53	185	35	100	1.06
7:54	185	35	100	1.06
7:55	185	35	100	1.06
7:56	185	35	100	1.06
7:57	185	35	100	1.06
7:58	185	35	100	1.06
7:59	185	35	100	1.06
8:00	185	35	100	1.06



CASE 2

HD #4

3. Normal size of cardiac chambers
 3. New poor Echo window regional wall motion abnormality (동맥경화) (동맥경화)
 Visually LV EF=20% (정상)

RV free wall hypokinesia with severe RV dysfunction (visually)
 RV wall 두께 감소 및 움직임 이상

3. Normal valvular shape and action without significant stenosis/insufficiency

4. No evidence of intracardiac mass or pericardial effusion

4. No evidence of resting pulmonary hypertension

6. LVOT T1=0cm

7. Transcatheter DT=normal

CONCLUSION: S/P ECMO (VA, 2020.09.16-), S/P TMC (2020.09.18-)
 1. Limited study due to poor Echo window
 2. Moderate to severe LV systolic dysfunction
 3. Severe RV dysfunction

HD #6

3. Normal size of cardiac chambers
 3. Preserved LV systolic function
 RV free wall hypokinesia except RV apex with RV dysfunction (visually)

3. Normal valvular shape and action without significant stenosis/insufficiency

4. No evidence of intracardiac mass or pericardial effusion

4. No evidence of resting pulmonary hypertension

6. LVOT T1=0cm

7. Transcatheter DT=normal

CONCLUSION: S/P ECMO (VA, 2020.09.16-), S/P TMC (2020.09.18-)
 1. Limited study due to poor Echo window
 2. Preserved LV systolic function
 3. Improved LV systolic function, visually LV EF=30% (정상) (covered with 3.RV dysfunction)

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Ulsan University Hospital

CASE 2

ECMO 제거 **V-A ECMO 재삽입**

HD #6

PaO ₂	90	186	95	74	85	62	64	60	460	559
PaCO ₂	33	41	58	38	32	29	27	33	21	23
	23	25	34	34	34	26	32	32	31	28
	0.3	-0.8	-12.8	-13.7	-13.7	-8.6	-9.9	-9.7	-5.2	-2.8
	0.5	-0.8	-12.9	-12.9	-12.6	-8.9	-9.2	-8.7	-3.7	-1.8
	35.3	24.4	14.5	14.7	15	17.8	17.6	18	22.1	23.6
	24	24.3	17.2	14.5	13.7	17.5	17	16.6	17.5	19.7
	95	25.6	19	15.7	14.7	18.7	18.1	17.6	18.1	20.4
	97	103	82	80	84	87	89	88	100	100
	139	139	134	136	137	140	136	139	136	137
	3.5	3.8	5.5	5.8	4.8	3.8	3.5	4	4.4	3.5
	1.13	1.14	1.2	1.16	1.26	1.1	1.06	1.11	1.09	1.07
	158	182	262	227	201	225	234	244	234	215
Lactate	1.2	1.3	6.1	6.4	7.8	7.5	9.2	8.8	6.9	6.6

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CASE 2

HD #7

HD #8

CONCLUSION: S/P ECMO reinsertion (VA, 2020.09.23-), S/P TMC (2020.09.18-)
 1. Limited study due to poor Echo window
 2. Absorbed (LV EF=45-50% (정상) and RV systolic function (normal) -> moderate) (covered with previous study 20.09.25 3. LVOT T1=0cm

Conclusion: 1. IVD
 2. Severe stenosis of RCA - RCA

HD #9

ECMO 제거 **V-A ECMO 재삽입**

PaO ₂	7.47	9.4	7.39	7.35	7.31	7.31	7.33	7.38	7.38
PaCO ₂	79	100	77	63	58	62	59	289	289
	23	32	35	23	23	13	16	21	21
	27	32	34	34	30	28	29	23	23
	2.5	1.2	2.2	-0.8	-2.1	-4.6	-6.9	-8.5	-8.5
	2.5	1	1.8	-1	-2.2	-4.3	-6.3	-7.5	-7.5
	26.9	25.7	25.3	24	23	21.4	19.8	19.1	19.1
	26.2	26	27.2	24.8	24.2	21.7	19	16.6	16.6
	27.3	27.3	28.6	26.2	25.9	25	20.1	17.5	17.5
	96	95	99	99	97	98	98	100	100
	139	139	138	137	136	137	134	138	138
	3.9	3.8	4.1	4.6	4.6	4.2	6.1	3.7	3.7
	1.17	1.16	1.14	1.11	1.16	1.12	1.04	1.05	1.05
	169	163	186	203	243	252	261	256	256
Lactate	1.2	1.2	1.1	2	2.1	3.3	5	15.5	15.5

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CASE 2

HD #15

ECMO 제거

PaO ₂	18	13	18	20	20	17	18	19	18	18	18
PaCO ₂	100	100	100	95	99	100	99	96	95	96	96
	37.1	36.9	36.9		37	37	36	37.2	37.3	38.1	38.1
	1.4	1.4	1.4	1.1	1.1	0.2					
	70										
	2.1	2.1	2.1	1.6	1.6	0.2					
	1797	1797	1797	1602	1603	1400					

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CASE 2


HD #19 Olecranon ORIF
 Medial malleolar fixation
 Knee joint capsule repair

HD #28 Permanent pacemaker implantation

HD #29 Inguinal wound debridement

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Ulsan University Hospital

CASE 2

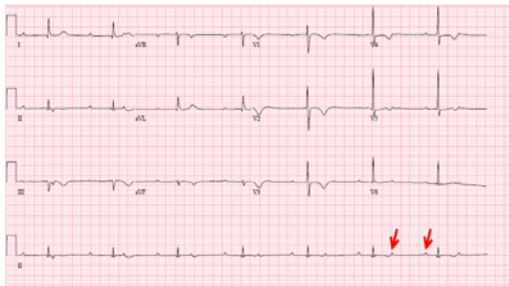


Ac
PA

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CASE 2


HD #25



울산권역외상센터
Ulsan University Hospital

CASE 2

HD #4



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Ulsan University Hospital

CASE 2

- ✓ 치료 과정 및 결과
 - RCA total occlusion(dissection 추정) 으로 인한 AMI 및 HF
 - 15일간 ECMO 치료
 - Complete AV block 으로 permanent pacemaker
 - HD #19 부터 외상에 대한 수술적 치료 진행
 - ICU 기간: 28일, 재원기간: 62일

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Ulsan University Hospital

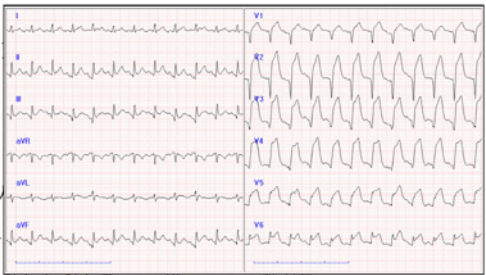
CASE 2

- ✓ 진단
 - Multiple rib fx. & Sternal fx.
 - Pneumothorax & Lung contusion
 - Patella & Femur open fx. Rt.
 - Medial malleolar fx. Rt.
 - Olecranon fx. Rt.
 - Complete AV block
 - **Acute MI**
 - ISS 18 -> 34

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CASE 2 -> CASE 1

- ✓ 남/34세
- ✓ 사고일: 20
- ✓ 출동 요청:
- ✓ 사고 기전
운전자 교통
운전 중 심근
첫 병원으로 이송 중, 이송 후 CPR 및 DC shock 2회 시행



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CASE 2 -> CASE 1

Catheter thrombectomy
: Small red thrombus

Balloon 2.5 x 11 (6 atm)
 Resolute Drix 2.75 x 38 (12 atm)
 No dissection
 TIMI 3 flow
 Conc) CAD (2VD) STEMI (ant. wall)

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CASE 2 -> CASE 1

- ✓ 진단
 - Lung contusion with aspiration
 - Liver contusion
 - Acute myocardial infarct
 - **Coronary artery thrombosis**
 - ISS 13 -> 29

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Coronary Artery Injury

- ✓ Blunt chest trauma causes direct cardiac damage in 5-15% of cases
- ✓ Various cardiac
- ✓ Acute MI: spasm
intra

Forensic Sci Med Pathol 2013

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권역응급의료센터
EMERGENCY MEDICAL CENTER

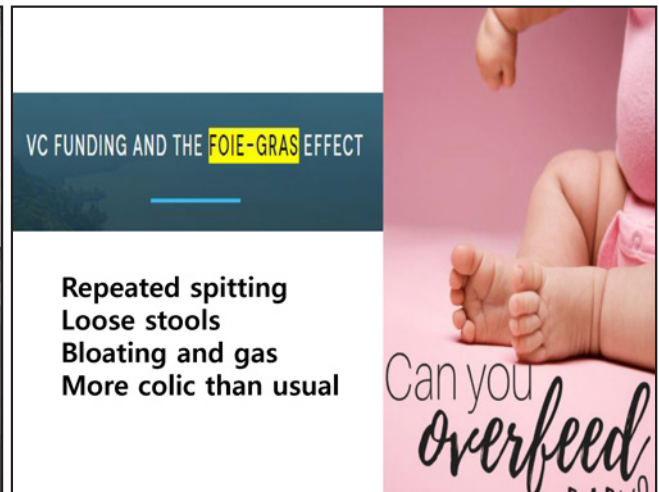
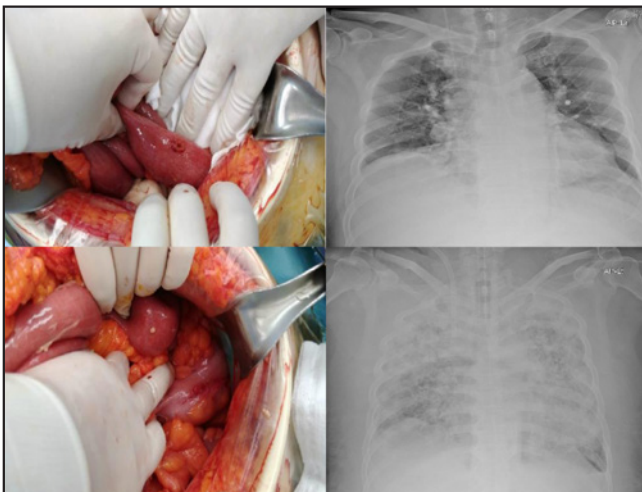
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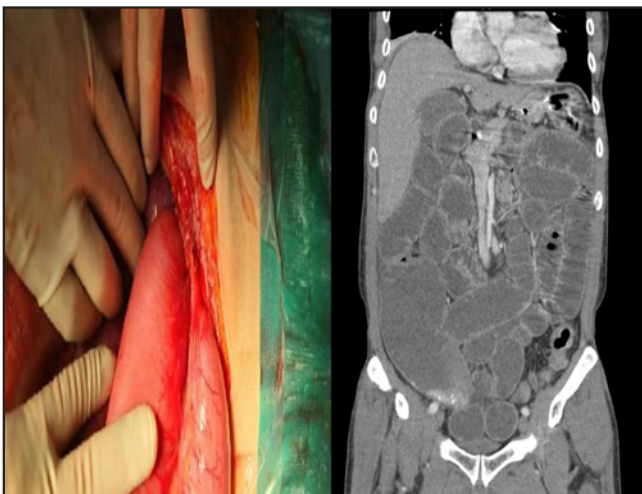
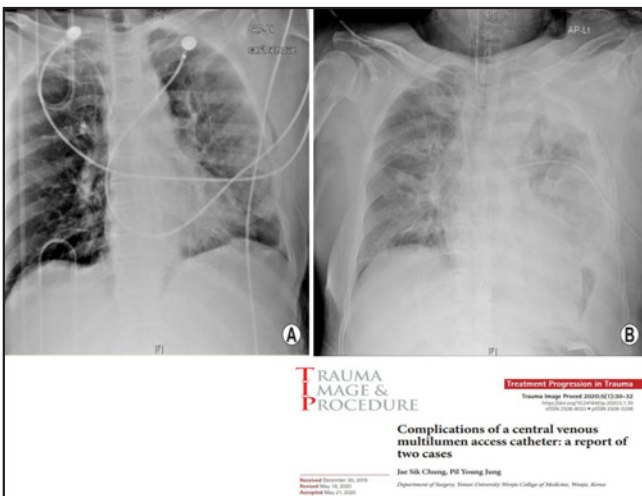
소아전용응급실 PEDIATRIC EMERGENCY ROOM
 권역외상센터 TRAUMA CENTER
 응급의료센터 EMERGENCY MEDICAL CENTER

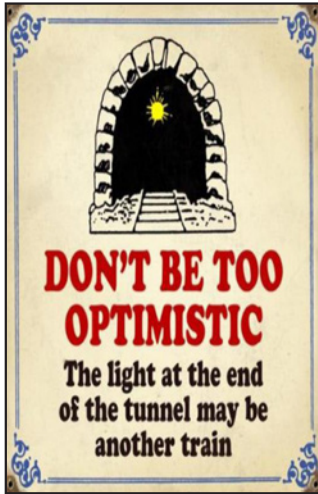
Worst Memories into Best Lessons

Pil Young Jung


Yonsei Univ., Wonju College of Medicine








Question

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<https://orcid.org/0000-0001-6460-8072>

 **Only dead patients, No patients to die.**
Set worst, Do best.

