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Laparoscopic Approach has Benefits in Gynecological Emergencies - Even for Massive Hemoperitoneum

Mircea Beuran[1], Ionut Negoi[1], Sorin Hostiuc[2], Fausto Catena[3], Massimo Sartelli[4], Ruxandra Irina Negoi[5], Sorin Paun[1]

[1]General Surgery Department, Emergency Hospital, Carol Davila University of Medicine and Pharmacy Bucharest, Romania
[2]Department of Legal Medicine and Bioethics, National Institute of Legal Medicine Mina Minovici, Carol Davila University of Medicine and Pharmacy Bucharest, Romania
[3]Department of Emergency Surgery, Maggiore Hospital, Parma, Italy.
[4]Department of Surgery, Macerata Hospital, Macerata, Italy
[5]Anatomy Department, Carol Davila University of Medicine and Pharmacy Bucharest, Romania

Rezumat

Abordul laparoscopic prezintă beneficii în urgențele ginecologice - chiar și în cazul hemoperitoneului masiv

Objective: Scopul acestui studiu este de a compara abordul laparoscopic cu cel deschis în hemoperitoneul de origine ginecologică.
Material și metodă: Studiu retrospectiv al pacienților internați între Ianuarie 2013 – Ianuarie 2015 într-un centru terțiar de urgență.
Rezultate: Au fost selectați 56 de pacienți, 27 în grupul laparoscopic (GL) și 28 în grupul deschis (GD). Urgența ginecologică a fost reprezentată de ruptura chistului ovarian în 20 (74%) versus 17 (59%) pacienți și de sarcina ectopică ruptă în 7 (26%) versus 12 (41%) pacienți în grupul laparoscopic și respectiv deschis. Principalul rezultat urmărit - scăderea medie intraoperatorie a hemoglobinei – a fost de 1.5 ± 1.2 g/dl în grupul laparoscopic și de 1.9 ± 1.4 g/dl în grupul deschis (p=0.344). Nu au fost observate diferențe între cele două grupuri privind rata transfuziei sanguine, necesarul de analgezice, rata complicațiior postoperatorii și durata spitalizării.
Concluzii: Abordul laparoscopic nu este inferior abordului deschis în abdomenul acut de origine ginecologică.

Cuvinte cheie: laparoscopie, urgențe ginecologice, hemoperitoneu

Abstract

Objective: The purpose of this study is to compare the laparoscopic with the open approach in hemoperitoneum of gynecological origin.
Materials and methods: Retrospective study of patients admitted to a tertiary emergency hospital between January 2013 – January 2015.
Results: There were 56 patients, 27 in the laparoscopic group (LG) and 28 in the open group (OG). The gynecological emergency was a ruptured ovarian cyst in 20 (74%) versus 17 (59%) cases, and an ectopic pregnancy with tubal rupture in 7 (26%) versus 12 (41%) patients in both the laparoscopic and open approaches, respectively. The main outcome - mean intraoperative hemoglobin decrease - was 1.5±1.2 g/dl in the laparoscopic and 1.9±1.4 in the open approach (p=0.344). There were no differences regarding red blood transfusion rate, needs for analgesics, postoperative complications and in-hospital stay.
Conclusion: The laparoscopic approach in acute abdomen of

Corresponding author: Ionut Negoi, MD, PhD
"Carol Davila" University of Medicine and Pharmacy, General Surgery Department
Emergency Hospital of Bucharest, Romania
No 8 Floreasca Street, Sector 1, 014461
E-mail: negoiionut@gmail.com

gynecologic origin is non-inferior to open surgery.

Key words: laparoscopy; gynecological emergencies; hemoperitoneum

Introduction

The initial evaluation of female patients with lower abdominal pain is often problematic in emergency settings. In these patients, the differential diagnosis includes many abdominal and pelvic disorders, with very broad therapeutic approaches, ranging from ambulatory treatment only, to in-hospital admission and emergency surgery. Fortunately, with the widespread availability of laparoscopy, such diagnoses may be definitively made by minimally invasive techniques, which correct an erroneous preoperative diagnosis in up to 40% of patients (1, 2). The most frequent cause of hemoperitoneum of gynecological origin in patients of childbearing age is represented by ectopic pregnancies or ruptured corpus luteal cysts. Rare causes are represented by uterine rupture, endometriosis and ruptured hydrosalpinx (3). The rate of ectopic pregnancies has increased during the last four decades, from 0.5 to 1.2-1.4% of all reported pregnancies, with as many as 15% of patients with ectopic pregnancy experiencing hypovolemic shock (4, 5). If the cause of the abdominal pain is suspected to be gynecologic in origin, and conventional diagnostic methods are unable to pinpoint the cause, the surgeon can perform a diagnostic laparoscopy and if needed, a laparoscopic therapy (6). The advantages of the minimally invasive approach for gynecological disorders are well-known, including a decrease in postoperative pelvis adhesions, less intraoperative blood loss, less analgesic requirements, a decreased length of hospital stay, an improved recovery time and important cost savings (7-9). However, in emergency settings the acute care surgeon may find the open approach more appropriate, especially when facing hemodynamic instability. On the other hand, the evidence coming from two invasive approach can be safely performed, in patients with hypovolemic shock due to ruptured ectopic pregnancy (10, 11).

The objective of the current study is to compare the feasibility and early morbidity of the laparoscopic approach with the open approach in hemoperitoneum of gynecological origin.

Method

Retrospective study of patients admitted in a tertiary university-affiliated hospital, during January 2013 – January 2015. The study was approved by our Institution Review Board (No. 11821 /2015). Patients were selected using the following criteria: (1) surgically confirmed gynecological disease, (2) surgical approach during the first 24 hours from admission. The main outcome of this study was to determine if the intraoperative hemoglobin decrease differs significantly between laparoscopy and open approach in patients with gynecologic emergencies. The secondary outcomes were: transfusion rate, number of doses of analgesics needed until discharge, presence of postoperative complications (classified according to Clavien-Dindo scale) and duration of in-hospital stay. We collected the following data: demographics, physiological parameters, imagistic and intraoperative findings, fluid and blood resuscitation, in-hospital course. We defined hemoperitoneum, as grade I when the quantity of blood was less than 500 ml, as grade II when it was between 500 and 1500 ml, and grade III when the performed by attending surgeons, according to their preference for a laparoscopic or an open approach.

Categorical variables were compared by the Chi-square test and continuous variables using the ANOVA test. Correlation analysis was performed using Kendall and Person tests. A level of $p<0.05$ was used to declare statistical significance. For statistical analysis we used IBM SPSS Statistics 20 software.

Results

There were 56 patients, 27 (48.2%) in the laparoscopic group (LG) and 29 (51.8%) in the open group (OG). The demographic data of the patients are detailed in *Table 1*. In the laparoscopic group, the gynecological disorder was a ruptured ovarian cyst (OC) in 20 (74%) patients and an ectopic pregnancy with tubal rupture (EP) in 7 (26%) patients. In the open group there were 17 (59%) OC and 12 (41%) EP; the differences between these two groups being not statistically significant (Chi2=1.490, p=0.222) (*Fig. 1*). Ultrasound sensitivity for hemoperitoneum was 88% versus 92% (Fischer's exact test, p=0.5), and for visceral lesion was 85% versus 31% in laparoscopic and open group, respectively (Chi2=15.442, p=0.001). Mean time from admission to operating room was 15.7±21.2 hours in LG compared to 5.9±10.8 hours in OG (T-Test, F=5.542, p=0.037). Hemoperitoneum magnitude was: grade I – 52% versus 20%, grade II – 37% versus 59% and grade III – 11% versus 21% in laparoscopic and open group, respectively (Fischer's exact test =5.824 p=0.56) (*Fig. 2*). The mean intraoperative hemoglobin decrease was 1.5±1.2 g/dl in LG

Table 1. *Results of laparoscopic versus open approach in gynecological emergencies*

	Laparoscopy group	Open group	Statistical significance*
Age (years) (Mean ± Std. Deviation)	27.96 (6.1)	30.97 (9.9)	F=0.248 p = 0.183
Heart rate on admission (Mean ± Std. Deviation)	93.83 (13.8)	83.29 (14.5)	F=0.075 p = 0.011
Hemoglobin (g/dl) on admission (Mean ± Std. Deviation)	11.73 (1.56)	10.93 (1.6)	F=0.003 p = 0.064
Minimum value of Hemoglobin (g/dl) during in-hospital stay (Mean ± Std. Deviation)	9.775 (2.2)	8.426 (2.1)	F=0.044 p = 0.048
Intraoperative hemoglobin decreasing (g/dl) (Mean ± Std. Deviation)	1.5 (1.2)	1.9 (1.4)	F=0.869 p = 0.344
Units of packed red blood cells transfused (Mean ± Std. Deviation)	0.15 (0.4)	0.37 (0.7)	F=6.318 p = 0.213

*Independent-Samples T-Test

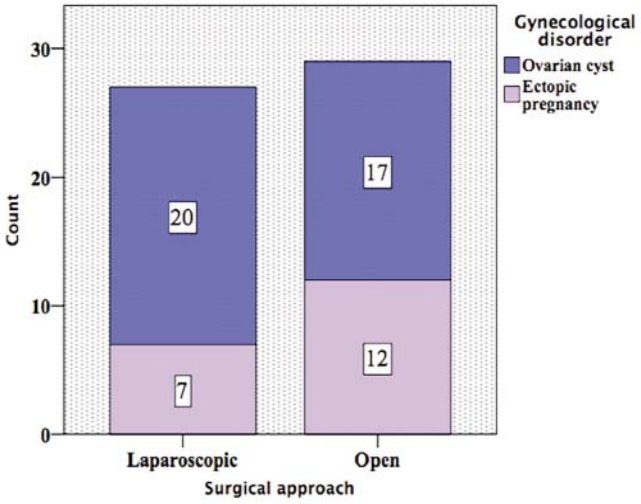

Figure 1. *The gynecological disease correlated with the therapeutic approach*

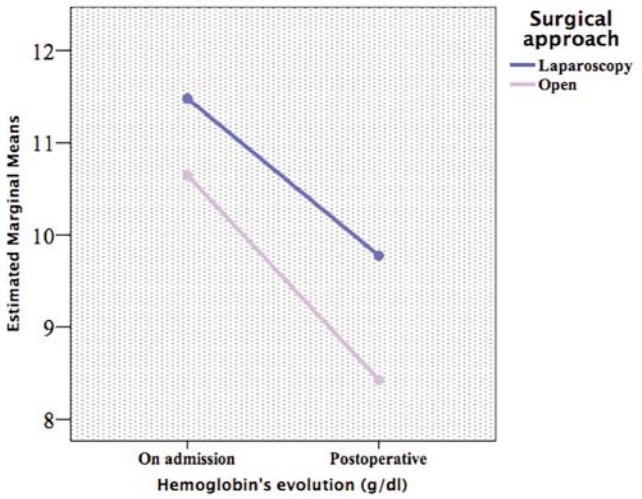

Figure 2. *The hemoperitoneum grade according to the therapeutic approach*

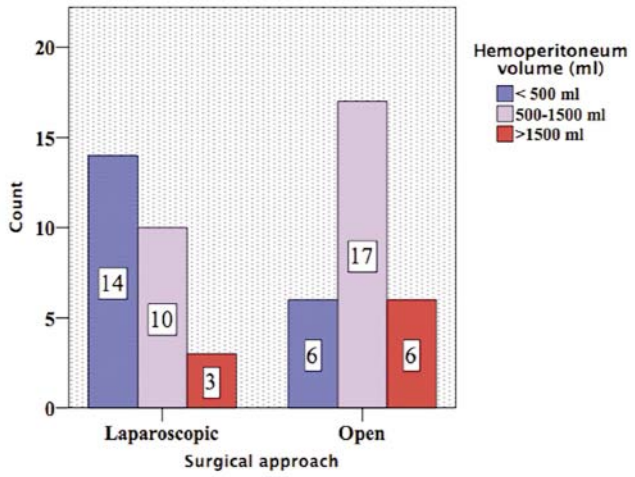

Figure 3. *Evolution of the hemoglobin according to the therapeutic approach*

and 1.9±1.4 in OG (ANOVA, F=0.918, p=0.344) (*Fig. 3*). By using conjointly the surgical approach and massive hemoperitoneum variables in a general linear model we obtained the following marginal mean intraoperative hemoglobin decreases: for laparoscopy - 1.475± 0.332 in patients without massive hemoperitoneum and 1.7± 0.767 in patients with massive hemoperitoneum; for the open approach - 1.813±0.332 for laparoscopy and 2.3±0.664 for the open approach (see *Table 2*). The differences were not statistically significant (F for the corrected model was 0.462, p=0.711)

If ultrasound was able to detect an organ lesion the preferred surgical approach was laparoscopy, while if it was unable to detect an organ lesion the preferred surgical approach was open (Pearson Chi2=15.442, p<0.001). See *Table 3* for details. Transparietal ultrasonography properly identified hemoperitoneum in 88% of LG and of 92% in OG cases (see *Table 4* for details). The differences between laparoscopic versus open approach were not statistically significant (Chi2=4.618, p=0.099).

The red blood transfusion rate was similar between the two groups (11.1% in LG and 27.6 in OG, Chi2=2.404, p = 0.121), with a mean number of packed red blood cells transfused of 0.15±0.4 units in LG and 0.37±0.7 units in OG (T-Test, F=6.318, p=0.213). The mean number of doses of analgesics needed until discharge was similar between the two groups, with 8.9± 3.2 versus 9.6± 3.3 doses in LG and OG, respectively (T-Test, F=0.185, p=0.458). The postoperative

Table 2. *General linear model – marginal means for the difference between admission Hemoglobin and immediately postoperative Hemoglobin in surgical the approaches with/without massive hemoperitoneum*

Surgical approach	Massive hemoperitoneum	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Laparoscopy	No	1,475	,332	,801	2,149
	Yes	1,700	,767	,143	3,257
Open	No	1,813	,332	1,138	2,487
	Yes	2,300	,664	,952	3,648

Table 3. *Laparoscopy versus open approach depending on the identification of organ lesions on the ultrasound*

Surgical approach	Ultrasonography detects organ lesion		
	Yes	No	Total
Laparoscopy	22	4	26
Open	8	18	26
Total	30	22	52

complication rate was similar between the two groups (22.2% in LG versus 20.7% in OG) (Chi2=0.02, days (OG) (T-Test, F = 1.938, p=0.443).

Discussions

The main result of our study showed, the laparoscopic approach in acute abdomen of gynecologic origin to be non-inferior compared to open surgery. There is no standardized management approach for hemoperitoneum of gynecological origin (3,12). The non-operative approach to hemoperitoneum is possible only for stable patients, in cases where, no active bleeding has been suspected; however, if the initial laboratory results show a significant decrease in hemoglobin levels (over 2 g/dl during 4 – 6 hours) or an increase in the quantity of hemoperitoneum, laparoscopy represents the preferred approach (3, 13). According to Bottomley and Bourne, the main indications for surgery are hemodynamic compromise and doubtful diagnosis (14). In our study we observed that laparoscopy was straightforward when the diagnosis was suggested by preoperative imagistics, while in doubtful cases an open approach was preferred.

In gynecological emergencies, transvaginal or transparietal ultrasonography in conjunction with pregnancy tests are the most frequently used diagnostic methods; together they are able to convey a proper differential diagnosis for most patients (15). Diagnostic laparoscopy has a higher accuracy compared to ultrasonography, its use proving the presence of a different pathology in up to 40% of cases (15). In our study, transparietal ultrasonography properly identified hemoperitoneum in 88% of LGs and of 92% in OGs (see *Table 4*), and was able to pinpoint the source of bleeding in 85% of LGs, but in only 31% of OGs (see *Table 3*).

A systematic review and meta-analysis comparing surgery with systemic methotrexate and expectant management in tubal ectopic pregnancy concluded that laparoscopic surgery is the most cost-effective treatment (16). Mining et al. evaluated the laparoscopic management of gynecological emergencies by residents and concluded that it is feasible, in a well-structured training program (17). The mean length of hospital stay was 40±24 hours, and was correlated with advanced patient age, prolonged length of surgery, pelvic inflammatory disease, first semester of chief residency and conversion to laparotomy (17).

Cohen et al. compared the safety and feasibility of laparoscopy with laparotomy in massive hemoperitoneum (> 800 ml) due to ruptured ectopic pregnancy (18). The median operating time was significantly shorter in the laparoscopic group (50 minutes versus 60 minutes, p = 0.001). although there were no differences regarding hemodynamic status, the median intra-abdominal blood loss was significantly greater in the laparotomy group (1500 ml versus 1000 ml, p = 0.002) (18). When we analyzed the subgroup of patients with hemoperitoneum over 500 ml, we did not see any statistically significant differences between LG and OG, proving non-inferiority of the laparoscopic approach in massive hemoperitoneum.

Cengiz et al. evaluated the effectiveness of laparoscopic surgery in patients with an elevated shock index due to ruptured ectopic pregnancy, using as a parameter the ratio of heart rate/systolic blood pressure (19). The postoperative hemoglobin level group. The mean postoperative hospital stay was 2.37±0.74 days in the laparotomy group and 2±0.84 days in the laparoscopic group (19), with the results being similar to those obtained by Mining et al (17). In our study the postoperative hemoglobin was 9.9±1.7 in LG and 8.6±1.8 in OG. The mean hospital stay in our group was 4.37 days for LG and 4.04 days for OG (p > 0.05). The most likely explanation for this difference is represented by the particularities of our healthcare system, where patients are discharged without being under close surveillance from general practitioners. For patients with massive hemoperitoneum due to ruptured ectopic pregnancy,

Table 4. *Detection of intraabdominal fluids using ultrasound*

Surgical approach			Detection of intraabdominal fluid using ultrasound		
			Yes	No	Total
Laparoscopy	Hemoperitoneum grade	Grade I	10	3	13
		Grade II	10	0	10
		Grade III	3	0	3
	Total	23	3	26	
Open	Hemoperitoneum grade	Grade I	5	1	6
		Grade II	14	1	15
		Grade III	5	0	5
	Total	24	2	26	
Total	Hemoperitoneum grade	Grade I	15	4	19
		Grade II	24	1	25
		Grade III	8	0	8
	Total	47	5	52	

Takeda et al. added intraoperative autologous blood transfusion to the laparoscopic approach (20). Out of 112 cases with ectopic pregnancy, there were 17 patients with hemoperitoneum over 501 grams. The mean amount of estimated intraabdominal bleeding was 680.6±209.5 g. There was no need for conversion to laparotomy or homologous blood transfusion (20). Intraoperative blood salvage may be an option for hemoperitoneum following an ectopic pregnancy (21).

Rizzuto, in a four year prospective observation study found that initially around 40% of total interventions for ectopic pregnancy with massive hemoperitoneum were laparoscopic; however, in the last year of the study all similar cases were managed using minimally invasive procedures (22). The authors concluded that laparoscopy, with its recognized advantages over laparotomy, is feasible for highly skilled anesthetic and surgical teams (22). For hemodynamically stable patients with ruptured corpus luteum and hemoperitoneum, the laparoscopic approach showed a shorter hospital stay compared to laparotomy (55.33± 7.67 versus 97.77±14.45 hours, $p<0.001$) without an increase in adverse events (23). Odejinmi et al. evaluated laparoscopy in hemodynamically unstable patients with ectopic pregnancy, and concluded that the minimally invasive approach is safe and sustainable in most women with hemodynamic instability. Patients treated with laparoscopy did not fare worse than those treated with laparotomy, and even those who require ICU admission still benefitted from this approach (24). The success rate in women with hemoperitoneum greater than 800 ml and hemodynamic instability was 100% for experienced operators and 72% for confident operators (24). According to Darwish et al., a major advantage of the laparoscopic approach for gynecological emergencies seems to be a higher fertility rate (25). They analyzed 152 patients with gynecological emergencies, of which 77 were included in the laparoscopic group (LG) and 75 in the open group (OG). Ectopic pregnancy was found in 78% of cases for LG versus 69% in the OG, twisted adnexa in 9% versus 16% of cases, and ruptured ovarian cyst in 7.8% versus 6.7%. At the 1-year follow-up, the fertility was 58.4% in the LG and only 32% in the OG ($p=0.001$) (25).

The main limitation of our study is its retrospective nature, with inherent selection bias that influenced the results. Other important limitations are the relatively small number of patients and the unicentric setting of the study, therefore its results should be interpreted with caution. The short-term follow-up is another limitation, that restricts our conclusions.

Conclusions

The laparoscopic approach in acute abdomen of gynecologic origin is non-inferior to open surgery, even in cases with massive hemoperitoneum. The minimally invasive approach provides diagnostic accuracy and therapeutic options, in patients with abdominal emergencies of gynecologic origin, even in cases with massive hemoperitoneum. The hemodynamic instability added to that the inexperience in laparoscopy are the only contraindications for the minimally invasive approach.

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References

1. Magos AL, Baumann R, Turnbull AC. Managing gynaecological emergencies with laparoscopy. BMJ : British Medical Journal. 1989;299(6695):371-4.
2. Sauerland S, Agresta F, Bergamaschi R, Borzellino G, Budzynski A, Champault G et al. Laparoscopy for abdominal emergencies: evidence-based guidelines of the European Association for Endoscopic Surgery. Surgical endoscopy. 2006;20(1):14-29. doi:10.1007/s00464-005-0564-0.
3. Fiaschetti V, Ricci A, Scarano AL, Liberto V, Citraro D, Arduini S et al. Hemoperitoneum from Corpus Luteal Cyst Rupture: A Practical Approach in Emergency Room. Case Reports in Emergency Medicine. 2014;2014:5. doi:10.1155/2014/252657.
4. Maruri F, Azziz R. Laparoscopic surgery for ectopic pregnancies: technology assessment and public health implications. Fertility and sterility. 1993;59(3):487-98.
5. Rana P, Kazmi I, Singh R, Afzal M, Al-Abbasi FA, Aseeri A et al. Ectopic pregnancy: a review. Arch Gynecol Obstet. 2013;288(4):747-57. doi:10.1007/s00404-013-2929-2.
6. Sauerland S, Agresta F, Bergamaschi R, Borzellino G, Budzynski A, Champault G et al. Laparoscopy for abdominal emergencies. Surgical Endoscopy and Other Interventional Techniques. 2006;20(1):14-29.
7. McWilliams GD, Hill MJ, Dietrich CS, 3rd. Gynecologic emergencies. The Surgical clinics of North America. 2008;88(2):265-83, vi. doi:10.1016/j.suc.2007.12.007.
8. Lundorff P, Thorburn J, Hahlin M, Källfelt B, Lindblom B. Laparoscopic surgery in ectopic pregnancy: A randomized trial versus laparotomy. Acta Obstetricia et Gynecologica Scandinavica. 1991;70(4-5):343-8.
9. Gray DT, Gray DT, Thorburn J, Strandell A, Lundorff P, Lindblom B. A cost-effectiveness study of a randomised trial of laparoscopy versus laparotomy for ectopic pregnancy. The Lancet. 1995;345(8958):1139-43.
10. Sagiv R, Debby A, Sadan O, Malinger G, Glezerman M, Golan A. Laparoscopic Surgery for Extrauterine Pregnancy in Hemodynamically Unstable Patients. The Journal of the American Association of Gynecologic Laparoscopists. 2001;8(4):529-32. doi:http://dx.doi.org/10.1016/S1074-3804(05)60615-9.
11. Soriano D, Yefet Y, Oelsner G, Goldenberg M, Mashiach S, Seidman DS. Operative laparoscopy for management of ectopic pregnancy in patients with hypovolemic shock. The Journal of the American Association of Gynecologic Laparoscopists. 1997;4(3):363-7. doi:http://dx.doi.org/10.1016/S1074-3804(05)80229-4.
12. Paun S, Negoi I, Ganescu R, Beuran M. Open to laparoscopic conversion in hemoperitoneum of unknown origin. European journal of trauma and emergency surgery : official publication of the European Trauma Society. 2012;38(1):79-81. doi:10.1007/s00068-011-0173-7.
13. Kim JH, Lee SM, Lee JH, Jo YR, Moon MH, Shin J et al. Successful conservative management of ruptured ovarian cysts with hemoperitoneum in healthy women. PloS one. 2014;9(3):e91171. doi:10.1371/journal.pone.0091171.

14. Bottomley C, Bourne T. Diagnosis and management of ovarian cyst accidents. Best practice & research Clinical obstetrics & gynaecology. 2009;23(5):711-24. doi:10.1016/j.bpobgyn.2009.02.001.
15. Agresta F, Ansaloni L, Baiocchi GL, Bergamini C, Campanile FC, Carlucci M et al. Laparoscopic approach to acute abdomen from the Consensus Development Conference of the Societa Italiana di Chirurgia Endoscopica e nuove tecnologie (SICE), Associazione Chirurghi Ospedalieri Italiani (ACOI), Societa Italiana di Chirurgia (SIC), Societa Italiana di Chirurgia d'Urgenza e del Trauma (SICUT), Societa Italiana di Chirurgia nell'Ospedalita Privata (SICOP), and the European Association for Endoscopic Surgery (EAES). Surgical endoscopy. 2012;26(8):2134-64. doi:10.1007/s00464-012-2331-3.
16. Mol F, Mol BW, Ankum WM, van der Veen F, Hajenius PJ. Current evidence on surgery, systemic methotrexate and expectant management in the treatment of tubal ectopic pregnancy: a systematic review and meta-analysis. Human reproduction update. 2008;14(4):309-19. doi:10.1093/humupd/dmn012.
17. Minig L, Velazco A, Lamm M, Velez JI, Venturini NC, Testa R. Evaluation of laparoscopic management of gynecologic emergencies by residents. International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics. 2010;111(1):62-7. doi:10.1016/ j.ijgo.2010.05.006.
18. Cohen A, Almog B, Satel A, Lessing JB, Tsafrir Z, Levin I. Laparoscopy versus laparotomy in the management of ectopic pregnancy with massive hemoperitoneum. International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics. 2013;123(2):139-41. doi:10.1016/j.ijgo.2013.05.014.
19. Cengiz H, Kaya C, Ekin M, Karakas S, Yasar L. Is laparoscopic surgery safe in patients with an elevated shock index due to ruptured ectopic pregnancy? Clinical and experimental obstetrics & gynecology. 2013;40(3):418-20.
20. Takeda A, Manabe S, Mitsui T, Nakamura H. Management of patients with ectopic pregnancy with massive hemoperitoneum by laparoscopic surgery with intraoperative autologous blood transfusion. Journal of minimally invasive gynecology. 2006;13(1):43-8. doi:10.1016/j.jmig.2005.09.100.
21. Liumbruno GM, Bennardello F, Lattanzio A, Piccoli P, Rossetti G. Recommendations for the transfusion management of patients in the peri-operative period. II. The intra-operative period. Blood Transfusion. 2011;9(2):189-217. doi:10.2450/2011.0075-10.
22. Rizzuto MI, Oliver R, Odejinmi F. Laparoscopic management of ectopic pregnancy in the presence of a significant haemoperitoneum. Archives of gynecology and obstetrics. 2008;277(5):433-6. doi:10.1007/s00404-007-0473-7.
23. Teng SW, Tseng JY, Chang CK, Li CT, Chen YJ, Wang PH. Comparison of laparoscopy and laparotomy in managing hemodynamically stable patients with ruptured corpus luteum with hemoperitoneum. The Journal of the American Association of Gynecologic Laparoscopists. 2003;10(4):474-7.
24. Odejinmi F, Sangrithi M, Olowu O. Operative laparoscopy as the mainstay method in management of hemodynamically unstable patients with ectopic pregnancy. Journal of minimally invasive gynecology. 2011;18(2):179-83. doi:10.1016/j.jmig. 2010.11.005.
25. Darwish AM, Zhakhera M, Youssef AA. Fertility after laparoscopic management of gynecologic emergencies: the experience of a developing country. Gynecological Surgery. 2007;4(2):85-90.