fortune Journals

Research Article

OBSTETRICS AND GYNECOLOGY RESEARCH

ISSN: 2637-4560

The Impact of Covid-19 Pandemic on The Management and Outcome of Adnexal Torsion: A Retrospective Study

Ho Ying Flora Wong[1]*, Ruoxing Du[2], Perita Amakiri[3], Lee Lim[4], Prasanna Raj Supramaniam[5]

Abstract

Objectives:

To evaluate the effects of COVID-19 on the management of suspected adnexal torsion

Methods:

Design: Retrospective case-controlled cohort

Setting: A tertiary hospital

Population: Women who underwent emergency surgery for suspected adnexal torsion from 24th March 2019 to 23rd March 2020 (Control group) and from 24th March 2020 to 23rd March 2021 (Pandemic group)

Methods: Electronic patient records reviewed. Parameters were compared with Mann-Whitney U and Fisher's exact tests

Primary outcome: Time from referral to gynaecology to diagnosis of torsion and time to theatre

Secondary outcomes: time from symptom onset to hospital presentation and oophorectomy rate

Results:

50%(25/50) of the pre-pandemic control group had adnexal torsion confirmed intra-operatively, compared to 58%(36/62) in the pandemic group. There were no statistical difference in the median time from referral to diagnosis (3 v.s. 9 hours, p=0.11) or median time from diagnosis to operation (7 v.s. 4 hours, p=0.27) between the control and pandemic groups. Out-of-hours operating was 4.5 times more likely in the pandemic group. 60%(n=15) of patients required non-ovarian sparing surgery (oophorectomy) in the control group, compared with 38%(n=14) in the pandemic group.

Conclusions:

A functional, well thought-out contingency plan in the face of a pandemic was crucial in order to prepare the hospital in times of crisis. Whilst there was an increase in the likelihood of out-of-hours operating during the pandemic, we have demonstrated that our ability to undertake diagnostic tests and to perform emergency surgery safely was not delayed overall due to the impacts of COVID-19.

Keywords: Adnexal torsion, Ovarian torsion, Emergency gynaecological surgery, COVID-19

Introduction:

On 11th March 2020 the World Health Organisation (WHO) declared a global pandemic secondary to rapidly rising COVID-19 cases coupled with its high infectivity rate. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first identified in Wuhan, China on the 31st December 2019 and this was later

Affiliation:

[1]Specialist Registrar in Obstetrics and Gynaecology, Oxford University Hospitals, Oxford, UK.

[2]Specialist Registrar in Obstetrics and Gynaecology, Oxford University Hospitals, Oxford, UK.

[3]Consultant Gynaecologist, Woman's Centre, John Radcliffe Hospital, Headington, Oxford, UK.

[4]Consultant Gynaecologist and Subspecialist in Reproductive Medicine and Surgery, Woman's Centre, John Radcliffe Hospital, Headington, Oxford, UK.

[5]Honorary Senior Clinical Lecturer in Reproductive Medicine and Surgery, Nuffield Department of Women's and Reproductive Health, University of Oxford, Oxford OX3 9DU.

***Corresponding author:**
Ho Ying Flora Wong, Specialist Registrar in Obstetrics and Gynaecology, Oxford University Hospitals, Oxford, UK.

Citation: Ho Ying Flora Wong, Ruoxing Du, Perita Amakiri, Lee Lim, Prasanna Raj Supramaniam. The Impact of Covid-19 Pandemic on The Management and Outcome of Adnexal Torsion: A Retrospective Study. Obstetrics and Gynecology Research. 7 (2024): 129-135

Received: December 01, 2024
Accepted: December 09, 2024
Published: December 27, 2024

Flora Wong HY., Obstet Gynecol Res 2024
DOI:10.26502/ogr0171

renamed to COVID-19 by the WHO [1]. The first COVID-19 case in England was identified on 31st January 2020. In February and March 2020, the number of hospital admissions and in particular admissions to intensive care units (ICU) rose [2]. Concerns on the capacity of the National Health Service (NHS) grew, both due to its finite limit of resources and the virus's rapid transmission rate.

To cope with the increasing demand on hospital beds and medical personnel, a key measure from the government in England was that hospitals should aim to suspend all elective (non-urgent) operations by April 2020 [3]. This had a two-fold impact on the healthcare system: firstly, by suspending elective operating, the number of bed spaces and ventilators available for COVID-19 patients were increased, whilst patient footfall and hence nosocomial transmission of the virus was reduced. Secondly, suspension of all non-emergency services allowed redeployment of medical staff to areas of greater need. The redeployment of staff had a further impact on the running of emergency operations and the capacity to staff theatres appropriately. Prior to the COVID-19 pandemic, each specialty within our large tertiary teaching hospital had direct access to their individual theatres to undertake both elective and emergency operations. The redeployment of theatre staff and anaesthetic doctors meant all specialties were asked to share between two theatres 24 hours a day for all emergency surgery. This change in theatre management dramatically impacted on how patients requiring emergency surgery were managed, particularly seen within our gynaecology department.

Many studies have evaluated how COVID-19 has impacted surgical patients given these unprecedented changes. Ali et al. noted that there was a delay in presentation and an increase in complications and extensive surgery in paediatric patients with appendicitis [4]. Similarly, Holzman et al. have also observed very similar findings for men presenting with testicular torsion [5]. One of the most important gynaecological emergencies is adnexal torsion [6]. The enlarged ovary and/or the fallopian tube twists on its own pedicle, causing a constriction in blood flow. This can lead to ischaemia and eventually necrosis of the ovary if prompt untwisting of the adnexa by surgery is not performed. Therefore, timely diagnosis and management of adnexal torsion is crucial to prevent permanent tissue damage and to reduce the damage to ovarian function. Whilst there are various imaging modalities that can be used to aid in the diagnosis of adnexal torsion such as pelvic ultrasound, magnetic resonance imaging (MRI) or computer tomographic (CT) scanning, definitive diagnosis of adnexal torsion can only be made via surgical confirmation, usually in the form of a laparoscopy.

The objective of this study is to evaluate how COVID-19 has affected the management of women who presented with suspected adnexal torsion.

Method

A retrospective case control cohort study was conducted in the Department of Obstetrics and Gynaecology at a large teaching hospital within Oxfordshire, with a broad network of referrals from different centres.

All emergency patients reviewed in the gynaecology ward between 24th March 2019 and 23rd March 2021 were identified via a electronic database search. The electronic medical records were then reviewed to identify patients requiring emergency gynaecology surgery during this period of time. Those who underwent a laparoscopy for acute pain were selected and further evaluated. Those who underwent surgery for the investigation of acute abdominal pain with suspected adnexal torsion were included. The patients were separated into control group or pandemic group, based on the date of surgery. The control group consisted of patients who had their operation between 24th March 2019 and 23rd March 2020. The pandemic group had their operation between 24th March 2020 and 23rd March 2021. The differential date of 24th March 2020 was selected as this was when both emergency and elective surgery were impacted due to the pandemic within the hospital based on government advice [7].

Electronic data record of all emergency gynaecology operations performed within the time-frame was obtained. Operation notes were reviewed to differentiate the patients with confirmed adnexal torsion from those who were found to have an alternative pathology during surgery. Patient records were reviewed for further details on demographics including age, referral source, duration of symptoms prior to admission, analgesia requirement, imaging details and admission blood results. Time-frames of the patients' hospital care were reviewed including referral time, gynaecology review time (initial review and consultant review) and operation start and finish time. Operation findings were collected from the patients' operation notes.

We aimed to review the impact of COVID-19 on the management of adnexal torsion due to the changes in working structure, reduction in theatre capacity and whether there was a reduction in the number of patients seeking medical assistance. The primary outcomes were: (1) time from referral to the gynaecology service to the diagnosis of adnexal torsion, and (2) time from diagnosis to surgery. The secondary outcomes were: (1) time from symptom onset to hospital presentation, and (2) the percentage of patients requiring an oophrectomy (i.e. non-organ sparing surgery).

These outcomes were compared between the control (pre-pandemic) group and the patients presenting during the COVID-19 pandemic. Statistical analysis was performed using SPSS. Parameters were compared with Mann-Whitney U for continuous variable data and Fisher's exact tests for categorical variables.

Results

The total number of acute admissions to the gynaecology emergency service was 2333 in the pre-pandemic control group (24th March 2019 - 23rd March 2020), compared to

Flora Wong HY., Obstet Gynecol Res 2024
DOI:10.26502/ogr0171

2610 in the pandemic group (24th March 2020 - 23rd March 2021). In the control group, 50 patients had emergency surgery for suspected adnexal torsion, with 50% (n=25) confirmed to have torsion intra-operatively, whilst in the pandemic group 62 patients underwent emergency surgery for the same indication, with 58% (n=36) confirmed to have adnexal torsion intra-operatively.

Demographic analysis on women presenting with confirmed adnexal torsion during surgery was performed [Table 1]. In the control group, the median age for women presenting with adnexal torsion was 33 years, with a range between 20 to 76 years; 80% of patients were of pre-menopausal age as defined by the WHO. The median age in the pandemic group is 32 years, with a range between 17 to 85 years; 92% of women were of pre-menopausal age. There was no statistical difference between the duration of symptoms prior to hospital admission between the two groups, with a median time of 48 hours in the control group and 24 hours in the pandemic group ($p > 0.05$, $p=0.08$). 84% and 89% of patients in the respective control and pandemic groups required analgesia stronger than paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs), such as codeine and or oramorph. All patients in both groups had at least one modality of imaging prior to the decision for diagnostic laparoscopy, unless they had a previously known adnexal cyst on recent imaging (within 3 months).

Table 1: Comparison of patient characteristics, timing, and ovarian outcomes among patients with confirmed adnexal torsion before and during COVID-19 pandemic. P-values are either Mann–Whitney U test or Fisher's exact test.

	Control group (n=25)	Pandemic group (n=36)	p-value
Age (range, median)	20-76 (33)	17-85 (32)	0.45
Pre-menopausal (n, %)	20 (80%)	33 (92%)	0.25
Analgesia stronger than ibuprofen/paracetamol (n, %)	21 (84%)	32 (89%)	0.71
Number of hours between symptom onset to hospital admission (range, median)	4-336 (48)	2-504 (24)	0.08
Onset of symptom to hospital admission > 18 hours (n, %)	21 (84%)	21 (58%)	0.049
Non-ovarian sparing surgery	15 (60%)	14 (38%)	0.12
Confirmed infarction or necrosis on histology	15 (60%)	12 (33%)	0.07
Number of hours between referral to gynaecology emergency service to diagnosis of suspected adnexal torsion (range, median)	1-114 (3)	1-102 (9)	0.11
Number of hours between diagnosis of suspected adnexal torsion and operating time (range, median)	0.5-45 (7)	1-53 (4)	0.27

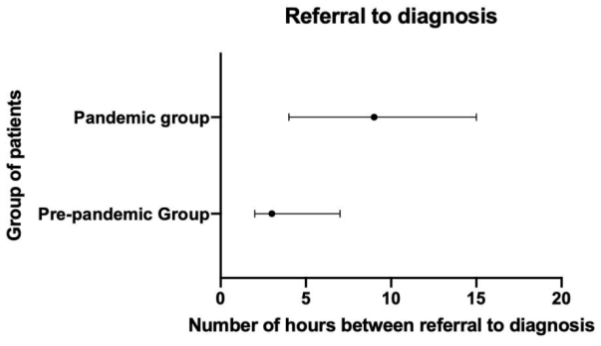

Figure 1: This figure shows the number of hours between patient referral to gynaecology services and when a diagnosis of possible adnexal torsion was made, as a comparison of timing between the pre-pandemic period and pandemic period. The interquartile range and median are shown.

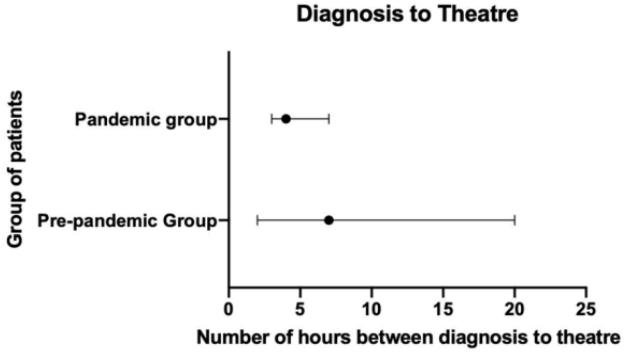

Figure 2: This figure shows the number of hours between diagnosis of possible adnexal torsion and the time of operation, as a comparison of timing between the pre-pandemic period and pandemic period. The interquartile range and median are shown.

Citation: Ho Ying Flora Wong, Ruoxing Du, Perita Amakiri, Lee Lim, Prasanna Raj Supramaniam. The Impact of Covid-19 Pandemic on The Management and Outcome of Adnexal Torsion: A Retrospective Study. Obstetrics and Gynecology Research. 7 (2024): 129-135.

Flora Wong HY., Obstet Gynecol Res 2024
DOI:10.26502/ogr0171

The median time taken from referral to gynaecology emergency service to diagnosis of suspected adnexal torsion was 3 hours (range 1-144 hours) in the control group and 9 hours (range 1-102 hours) in the pandemic group, with no statistical difference between the two groups (p>0.05, p=0.11) [Figure 1]. The median time taken between diagnosis of suspected adnexal torsion and operating time was 7 hours (range 0.5-45 hours) in the control group and 4 hours (range 1-53 hours) in the pandemic group, with no statistical difference between the two groups (p>0.05, p=0.27) [Figure 2].

In the pandemic group 47% patients had their diagnosis during working hours (Monday to Friday 0800 to 1700), compared to 40% in the control group. However, only 33% of those patients went on to have surgery the same day in-hours in the pandemic group, with all those in the control group having in-hours surgery. Patients in the pandemic group were 6.5 times more likely to have their surgery out-of-hours when compared to the control group (OR 6.5 95%CI 1.36-31.09, p=0.01). Of the 43% of patients having their diagnosis out-of-hours in the pandemic group 22% went on to have surgery in the out-of-hours setting, compared to 8% in the control group; a further 52% of patients who had an out-of-hours diagnosis went on to have in-hours surgery the following day in the control group. This is reflective of the inability to predict theatre capacity the following day during the pandemic as compared to the pre-pandemic group [Figure 3]. Out-of-hours surgery was 4.5 times more common in the pandemic group overall. There was also no statistical difference in the number of hours between diagnosis to surgery time in the two groups, when comparing the time of the day the patient was referred or had a decision made for theatre.

Surgical outcomes demonstrated that 60% (n=15) of patients required non-ovarian sparing surgery (oophorectomy) in the pre-pandemic group, compared with 38% (n=14) in the pandemic group. On review of histopathology reports, 60% (n=15) had histologically confirmed torsion in the pre-pandemic group, compared with 33% (n=12) in the pandemic group.

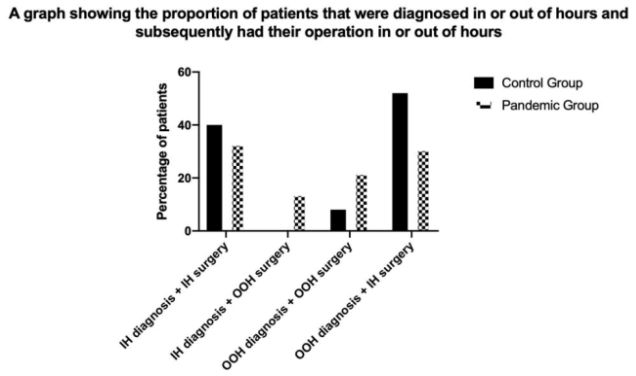

Figure 3: This figure shows the proportion of patients that had a diagnosis made during working hours or out-of-hours and then subsequently had their operation in- or out-of-hours. In-hours (IH) is defined as Monday to Friday 0800 - 1700, and out-of-hours (OOH) is defined as outside of those hours.

Discussion

Main Findings

This is the first retrospective study to evaluate the impact of a pandemic on service delivery impacting the management of a gynaecological emergency and in particular on adnexal torsion. The evaluation was performed in a large teaching hospital in the UK, which covers a large geographical area receiving referrals from smaller regional centres and thus representative of women accessing healthcare during the pandemic.

This primary outcome of the study identified that COVID-19 pandemic did not have a direct impact on the overall outcome of the women with suspected adnexal torsion. There was no statistical difference in the number of hours between decision for theatre and surgery time in the pandemic group compared to the control group. This was despite the pandemic affecting the way that the healthcare service operated, with a reduction of theatre capacity and resources [8]. This was due to a multidisciplinary approach in better triaging the urgency of surgical cases across specialties, and increased consultant involvement to ensure the most appropriate cases were taken to theatre. One large systematic review highlighted that the commonest changes to surgical services included the modification to workforce, approach to patient care and triage criteria for surgical cases [9]. Within our study, we have noted that the key in sharing theatres between multiple specialties was triaging clinical urgency [10]. The pandemic has highlighted the importance of good communication and organisation between teams to ensure the system is run to its maximum capacity.

Furthermore, there was no significant difference found between the number of hours from gynaecology referral to the diagnosis of adnexal torsion in the pandemic group and in the control group. This highlighted that clinical care was not compromised due to extra infection control precautions or staffing issues. For emergency cases, due to the reduction of elective operations and workload, this also meant that consultants and senior staff were more readily available to be able to attend and review unwell patients to make a prompt clinical decision.

This study highlighted an increase in out-of-hours operating during the pandemic period, regardless of the time in the day at which the patient presented to the acute gynaecology services. This was likely due to reduced resources during weekday working hours in the pandemic, such as a reduction in theatre capacity. A previous study by Ndegbu et al. has demonstrated that night-time operating did not influence the outcome of the operation [11]. Similarly,

Flora Wong HY., Obstet Gynecol Res 2024
DOI:10.26502/ogr0171

within out study, there were no operative complications and the rate of oophorectomy was not increased as a result of out-of-hours operating.

Most importantly, there were no statistical differences on the management of adnexal torsion or its outcome before and during the pandemic. This was a reassuring finding to demonstrate that the care of women was not comprised despite the reduction in staffing levels and theatre availability. This is particularly important in the context of adnexal torsion, as the consequence of losing an ovary can have devastating effects on an individual [12].

Strengths and Limitations

One limitation of our study was the single centre model, and thus we were only able to examine the patients that presented to our services. The number of patients visiting our hospital was steady over the two-year period, suggesting that there was no obvious variation due to people's change in lifestyles or behaviour during the pandemic.

A strength in our study was that we were able to account for possible seasonal variation by analysing data across a whole 12-month period. This also allowed evaluation of the longer-term effect of COVID-19 pandemic being evaluated following the acute phase.

Interpretation

COVID-19 changed the face of how emergency care is being provided. The pandemic placed a unique requirement on healthcare providers not experienced in modern time, requiring them to treat acute emergencies without compromise and also to balance the workflow of patients presenting with acute emergencies. This included the introduction of testing of all patients being admitted to the hospital [13], separating patients with a high suspicion of COVID-19 and providing HCP with the correct personal protective equipment (PPE), when emergency operation was required for a patient with a positive or unknown COVID status [14]. In this study, we note that there were no significant delays in reviewing patients or in patients having their operation. This suggests that a well-developed workflow can improve the efficiency at time of increased demand with reduction in supply.

The emergency theatre availability within the hospital was drastically reduced during the COVID-19 pandemic due to one emergency theatre being shared between multiple specialties 24 hours a day. Thus, the ability to work in a multidisplinary team and to effectively communicate the urgency for surgery was crucial in planning the surgical list order, especially when the workload was shared across multiple specialties.

The number of patients attending emergency departments was shown to be reduced during the pandemic in 2020. This was evident across several different countries in all specialties [15, 16]. Patients' anxiety of attending hospitals, social distancing and concerns on overwhelming the healthcare system were widely reported as factors to why there was a reduction in hospital footfall. However, this reduction did not appear to be sustained as patient numbers returned to pre-pandemic levels after several months of the lockdown as living in a pandemic became the new normality and health concerns continued to bother them. Besides this, we noted a reduction in acute emergencies to gynaecology department in the initial three months during 2020. However, the levels quickly rose above the average expected admission in the following months as patients were increasingly reassured by the safety measures within hospitals to reduce COVID-19 infection transmission. This overall increase in emergency admissions in the pandemic year may also be in part contributed by the suspension of the non-acute gynaecology clinic appointments. In the initial period of the pandemic, patients with routine elective appointments such as those with heavy menstrual bleeding and chronic pelvic pain were given treatments options to manage their condition in the community along with guidance from the Royal College of Obstetricians & Gynaecologist and Endometriosis UK. However, this management was not sustained and a portion of patients attended as emergency admissions requiring additional support. This link will need to be further evaluated in order to understand the spike in admissions and the impact of suspension of elective services.

An initial concern was that patients may delay presentation to healthcare services due to concerns of exposure to COVID-19 within healthcare settings [17, 18]. However, this was not found in this study as the onset of symptoms to referral times were similar between the two groups. Patients did not delay seeking medical help, and this may be attributed to the nature of the acute condition and the severity of pain leading to a need for urgent treatment. In addition, this study has highlighted that there was no change in the number of patients with confirmed adnexal torsion, demonstrating that despite the pandemic, women were still able to access the care that they required.

Evaluating the impact of the COVID-19 pandemic on the long-term health of surgical patients, in contrast with studies looking at testicular torsion, a mixture of outcomes was identified. A multicentre study in United States and Canada found that there was a significant increase in orchidectomy rate during COVID-19 pandemic than previously (42% from 29%). The data suggested that there was a significantly longer delay in presentation to seeking care from the onset of symptoms [5]. This is likely due to the population's concern over hospital visits during a pandemic verses their concern in their health. By contrast, a study by Nelson et al. showed there was no significant difference in orchidectomy rate, time of symptom onset to presentation or the time from presentation to surgery [19]. The limitation of this study was that it only included a single centre.

There are currently no other studies looking specifically at adnexal torsion and the rate of oophorectomy during the COVID-19 pandemic. We note that our rate of oophorectomy across the two years were similar, if not slightly improved in the pandemic group. During the pandemic, a new protocol for the management of adnexal torsion was implemented, which reinforced and improved early diagnosis and decision to theatre time. This supported the clinicians' diagnostic skills as well as improved awareness on the importance in ovarian-preserving surgery. This is crucial as the loss of an ovary can lead to a reduction in reproductive function as well as premature menopause in some women.

Conclusion

The COVID-19 pandemic has affected healthcare delivery in many ways as demonstrated above, with regards to cancellation of elective operation and outpatient clinic reviews, as well as a reduction in emergency operating capacity. Healthcare professionals were required to adapt and deliver clinical reviews in new innovative ways, largely incorporating the use of digital platforms such as video consultations. A key message that echoed throughout the healthcare community was to ensure patient care was not compromised even at the height of the pandemic. A functional, well thought-out contingency plan in the face of a pandemic was crucial. Our study demonstrated that the use of effective communication and a multidisciplinary working model were essential to delivering emergency care in a safe and timely fashion during times of crisis.

Acknowledgements

The authors would like to thank all healthcare professionals who continue to strive in delivering excellent service despite the constrains placed by the pandemic.

Conflict of Interest Statement

The authors have no conflicts of interest.

Contribution to Authorship

PRS was responsible for conceiving, designing and overseeing the study. HW, RD and PA were responsible for the data collection. HW, RD and PRS analysed the data. HW and RD wrote the first draft of the study. All authors contributed to the editing of the manuscript, and approved the final version for submission.

Details of Ethics Approval

This study was approved by the clinical governance department at the John Radcliffe Hospital.

Funding

No funding was sought or obtained to undertake this study.

References

1. Organisation WH. WHO Director General's opening remarks at the media briefing on COVID-19 2020 [updated 2020/03/11/. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020.
2. ICNARC. ICNARC report on COVID-19 in critical care 27 March 2020 2020 [updated 2020/3/27. Available from: https://www.icnarc.org/DataServices/Attachments/Download/b5f59585-5870-ea11-9124-00505601089b.
3. Improvement NEaN. Next Steps on NHS response to COVID-19 2020 [updated 2020/03/19/. Available from: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/urgent-next-steps-on-nhs-response-to-covid-19-letter-simon-stevens.pdf.
4. Ali S, Khan MA, Rehman IU, et al. Impact of covid 19 pandemic on presentation,treatment and outcome of paediatric surgical emergencies. Journal of Ayub Medical College, Abbottabad 32 (2020): S621-S624.
5. Holzman S, Ahn JJ, Baker Z, et al. A multicenter study of acute testicular torsion in the time of COVID-19. Journal of Pediatric Urology S1477-5131 (2021): 00129-7.
6. Emmanuel Damigos Ptychio latrikes, Jemma Johns, Ross J. An update on the diagnosis and management of ovarian torsion. The Obstetrician & Gynaecologist 14 (2012): 229-236.
7. Trust OUHNF. COVID-19 - Postponement of non-urgent inpatient operations and outpatient appointments. Oxford University Hospitals NHS Foundation Trust. (2020).
8. Søreide K, Hallet J, Matthews JB, et al. Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services. Br J Surg 107 (2020): 1250-1261.
9. O'Rielly C, Ng-Kamstra J, Kania-Richmond A, et al. Surgery and COVID-19: a rapid scoping review of the impact of the first wave of COVID-19 on surgical services. BMJ Open 11 (2021): e043966.
10. Al-Jabir A, Kerwan A, Nicola M, et al. Impact of the Coronavirus (COVID-19) pandemic on surgical practice - Part 2 (surgical prioritisation). International Journal of Surgery 79 (2020) (1743-9159 (Electronic)): 233-248.
11. Ndegbu CU, Olasehinde O, Sharma A, et al. Daytime Versus Night-Time Emergency Abdominal Operations: Perspective from a Low-Middle-Income Country. World J Surg 43 (2019): 2967-2972.
12. Robertson JJ, Long B, Koyfman A. Myths in the Evaluation and Management of Ovarian Torsion. J Emerg Med 52 (2017): 449-456.

Flora Wong HY., Obstet Gynecol Res 2024
DOI:10.26502/ogr0171

13. Wake RM, Morgan M, Choi J, et al. Reducing nosocomial transmission of COVID-19: implementation of a COVID-19 triage system. Clinical Medicine 20 (2020): e141.

14. Ağalar C, D ÖE. Protective measures for COVID-19 for healthcare providers and laboratory personnel. Turkish Journal of Medical Sciences 50 (2020): 578-584.

15. Abel MK, Alavi MX, Tierney C, et al. Coronavirus Disease 2019 (COVID-19) and the Incidence of Obstetric and Gynecologic Emergency Department Visits in an Integrated Health Care System. Obstetrics & Gynecology 137 (2021): 581-583.

16. Wong LE, Hawkins JE, Langness S, et al. Where are all the patients? Addressing Covid-19 fear to encourage sick patients to seek emergency care. N Engl J Med 383 (2020): 691-693.

17. Goyal M, Singh P, Singh K, et al. The effect of the COVID-19 pandemic on maternal health due to delay in seeking health care: Experience from a tertiary center. International Journal of Obstetrics and Gynecology. 2020;152:231–5.

18. Bodilsen J, Nielsen PB, Søgaard M, et al. Hospital admission and mortality rates for non-covid diseases in Denmark during covid-19 pandemic: nationwide population based cohort study. BMJ 373 (2021): n1135.

19. Nelson CP, Kurtz MP, Logvinenko T, et al. Timing and outcomes of testicular torsion during the COVID-19 crisis. Journal of Pediatric Urology. 16 (2020): 841.e1–e5.