Open Journal of Obstetrics and Gynecology, 2024, 14, 1591-1601
https://www.scirp.org/journal/ojog
ISSN Online: 2160-8806
ISSN Print: 2160-8792

Polymyomectomy during Cesarean Section at the University Hospital Center of Brazzaville (Congo): About a Case and Review of the Literature

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How to cite this paper: Jostin, B.G.R., Bialay, P.M.N.S., Emmery, E.M.L., César, I.M.J. and Clautaire, I. (2024) Polymyomectomy during Cesarean Section at the University Hospital Center of Brazzaville (Congo): About a Case and Review of the Literature. *Open Journal of Obstetrics and Gynecology*, **14**, 1591-1601.
https://doi.org/10.4236/ojog.2024.1410130

Received: August 9, 2024
Accepted: October 22, 2024
Published: October 25, 2024

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Abstract

Introduction: Myomectomy during cesarean section has long been a controversial subject. The increased risk of intraoperative hemorrhage and potential hysterectomy has led many teams to contraindicate it, postponing it three to six months after delivery, thus giving more time for uterine involution, myoma shrinkage and reducing operative time and blood loss. **Clinical Observation:** We report the case of a polymyomectomy after use of a segmental tourniquet and bilateral ligation of the hypogastric arteries during a cesarean section for hemorrhagic placenta previa at the end of a spontaneous pregnancy of 28 weeks of amenorrhea in a 42-year-old nulliparous primigravida patient. **Conclusion:** Polymyomectomy during cesarean section is possible and requires knowledge of preventive hemostasis techniques and surgical experience.

Keywords

Polymyomectomy, Caesarean Section, Tourniquet, Vascular Ligation, Brazzaville

1. Introduction

Also called fibroid, fibromyoma or leiomyoma, uterine myoma is a pseudo-encapsulated benign tumor, developed at the expense of the uterine muscle [1]. It is

the most common benign uterine tumor affecting 20% to 40% of women of childbearing age [2]. Its association with pregnancy makes it a high-risk pregnancy. Several authors have reported the reciprocal influences of pregnancy on myoma (growth, aseptic necrobiosis, compression), of myoma on pregnancy (miscarriage, premature delivery, malpresentation, intrauterine growth retardation, placenta previa, dynamic or mechanical dystocia, postpartum hemorrhage) and an increase in the cesarean section rate [3]-[8]. Myomectomy during cesarean section (MC) has long been a controversial subject [3]-[5] [7] [9]-[11]. The increased risk of intraoperative hemorrhage and potential hysterectomy has led many teams to contraindicate it, postponing it three to six months after delivery, thus giving more time for uterine involution, shrinkage of myomas and reducing operative time and blood loss [3] [4] [10]. Nowadays, most schools agree that MC should only be performed for myomas compromising the safety of fetal extraction or incision and/or suture of the lower segment, by experienced surgeons, competent in myomectomies on non-pregnant uteri [5] [12]-[14]. We report the case of a polymyomectomy during a cesarean section for hemorrhagic placenta previa at 28 weeks of amenorrhea in the Gynecology-Obstetrics department of the University Hospital Center of Brazzaville.

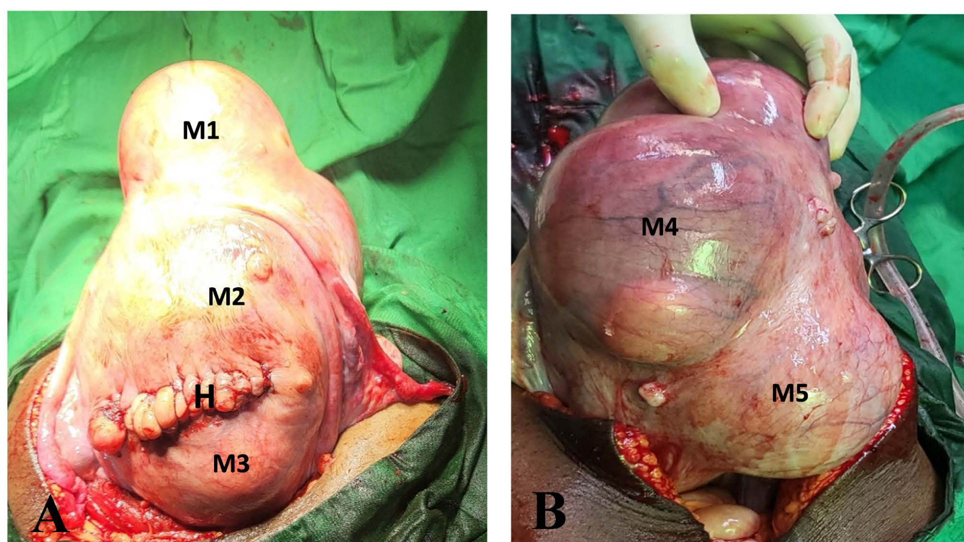
2. Clinical Observation

This was a 42-year-old pregnant woman, a saleswoman, who had been staying for four days in the Gynecology and Obstetrics department of the Brazzaville University Hospital for hemorrhagic placenta previa at 28 weeks of amenorrhea (theoretical term) after secondary infertility in a context of polymyomatous uterus. Indeed, she is a second-time mother and nulliparous with a history three years ago of late spontaneous miscarriage at about five months of pregnancy. The current pregnancy was spontaneous and followed late by an Obstetrician-Gynecologist at the rate of two prenatal contacts. The symptoms on arrival are made up of sudden, unexpected genital bleeding, bright red in appearance, of average abundance, intermittent, capricious and painless. On examination, we note a good coloration of the conjunctival mucous membranes and a good hemodynamic state. The uterine height is 30 cm. Speculum examination confirmed the presence of metrorrhagia. Obstetric ultrasound revealed an evolving singleton pregnancy with anterior placenta previa type II of the BESSIS classification [15]. Biologically, the hemoglobin level was 9.5 g/dl. The therapeutic approach consisted of expectant management, maturational corticosteroid therapy and administration of iron-based drugs at a curative dose. The evolution on the fourth day of hospitalization was marked by the sudden onset of very abundant genital bleeding. On examination, severe pallor of the conjunctival mucosa was noted, blood pressure was 80 mm systolic and 60 mm diastolic, heart rate was 112 beats per minute and respiratory rate was 32 cycles per minute.

An emergency cesarean section was indicated for hemorrhagic placenta previa with hemodynamic instability and clinical anemia. With a view to a potential

polymyomectomy, four units of red blood cells, more oxytocin, injectable tranexamic acid and sutures (VICRYL 3.5/0; 4/1 and 5/2) were mobilized.

After a midline sub umbilical skin incision, an intramural segmental myoma was discovered at the celiotomy, requiring a transverse segmental and corporeal cesarean section, which allowed the extraction of a newborn in a state of apparent death, Apgar score 3, 4, 5 respectively at the 1st, 5th and 10th minute. Having weighed 900 g, the newborn was resuscitated and transferred to the neonatology department. Hysterorrhaphy with 4/1 VICRYL suture was performed using an extra mucosal running suture reinforced by separated U-shaped stitches. Exploration after exteriorization of the uterus revealed a large polymyomatous uterus with several nodules, the largest of which were interstitial corporeal (anterior and posterior) and sessile sub-serosal fundic (Figure 1). The adnexa were macroscopically healthy.



A: Polymyomatous uterus (anterior view). M1: Postero-fundal sessile sub serosal nodule. M2: Antero-corporeal interstitial nodule. M3: Anterior segment-corporeal nodule. H: Post cesarean hysterorrhaphy. B: Polymyomatous uterus (posterior view). M4 and M5: Postero-corporeal sessile sub serosal nodules.

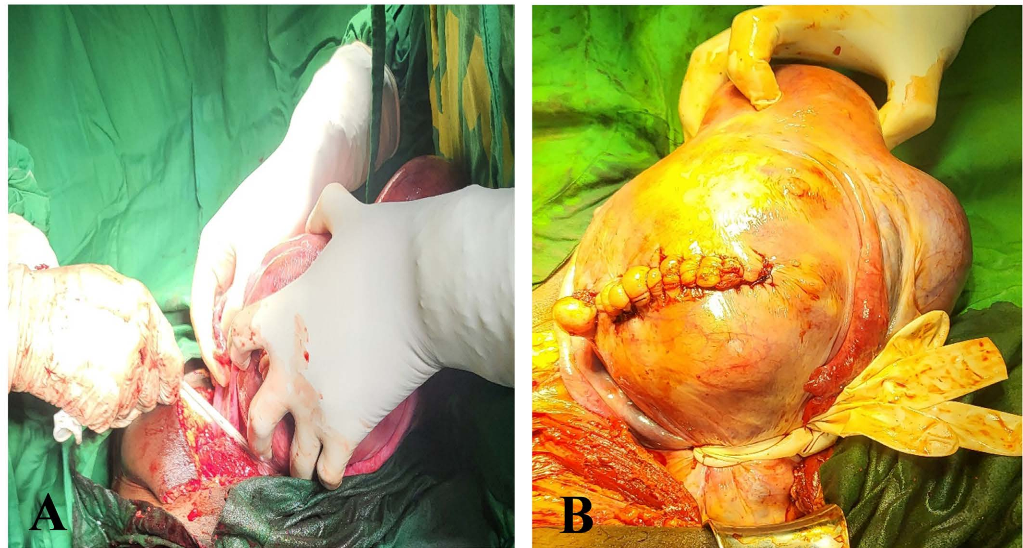
Figure 1. Polymyomatous uterus exteriorized after cesarean section.

The decision to perform polymyomectomy was taken for the following reasons:

- the advanced age of the pregnant woman;
- the notion of primary infertility in the context of a polymyomatous uterus resulting in a spontaneous pregnancy complicated by placental insertion abnormality;
- the macroscopically healthy appearance of the adnexa predicting good tubal permeability and the presence of ovulatory cycles, which does not exclude a subsequent assessment of the ovarian reserve;
- the poor neonatal prognosis linked to the very high prematurity induced by the cesarean section in a maternity context with limited resources, which could

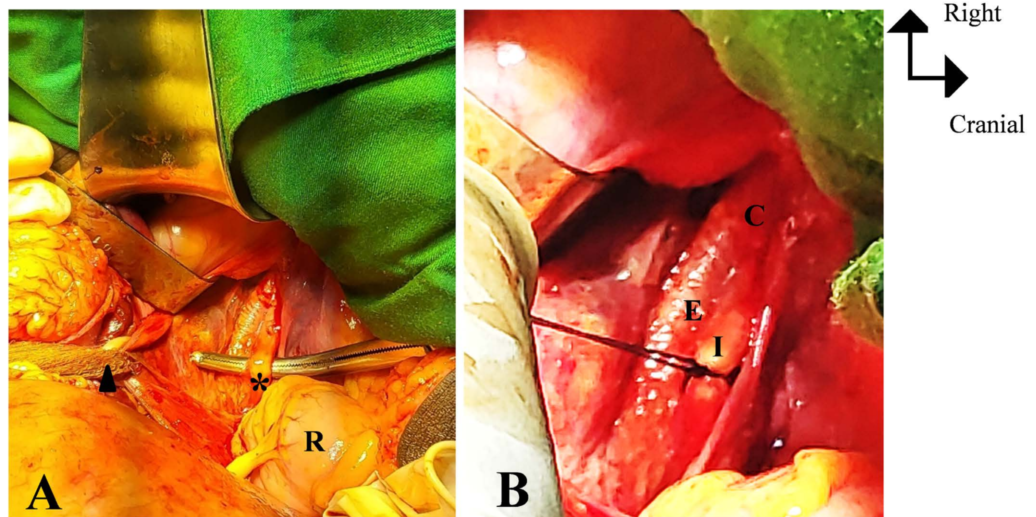
contribute to making her a childless woman;
- the precarious economic conditions.

Prevention of intraoperative hemorrhage and postpartum hemorrhage was done by applying a tourniquet at the segmental level using a knotted sterile glove hand followed by bilateral ligation of the hypogastric arteries (**Figure 2** and **Figure 3(a)**, **Figure 3(b)**).



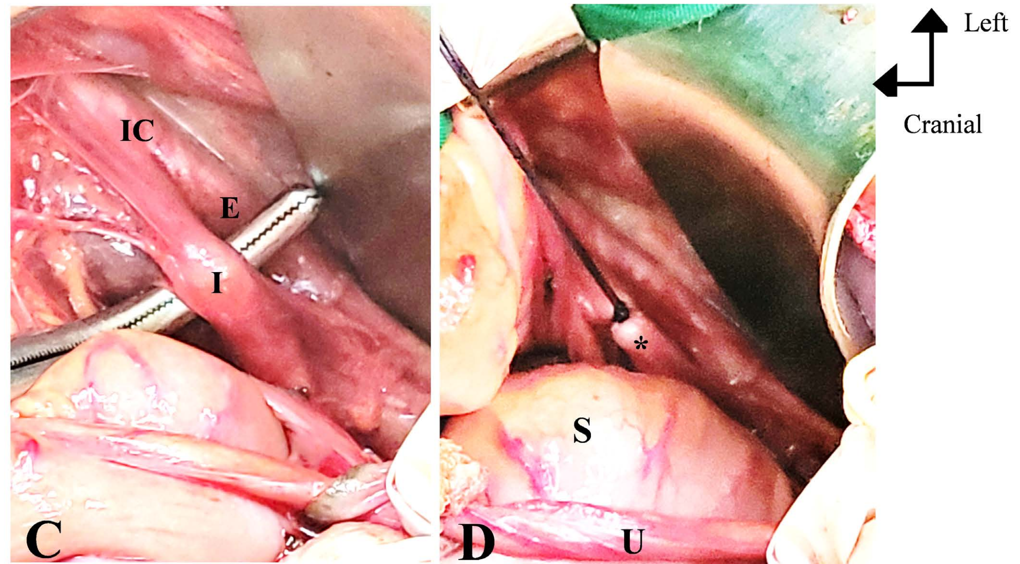
A: Tying the low segmental tourniquet using a sterile gloved hand. B: Polymyomatous uterus with a low segmental tourniquet taking the broad, round and lumbo-ovarian ligaments (anterior view).

Figure 2. Segmental tourniquet for hemostatic purposes.



A: Exposure of the right iliac vessel sheath after opening the abdominal wall arrowhead. Betadine-soaked compress is used as a lacquer to isolate the right ureter. *: Right internal iliac artery exposed by a dissector. R: Rectum. B: Right iliac vessels. C: Common iliac artery. I: Internal iliac artery ligated. E: External iliac artery.

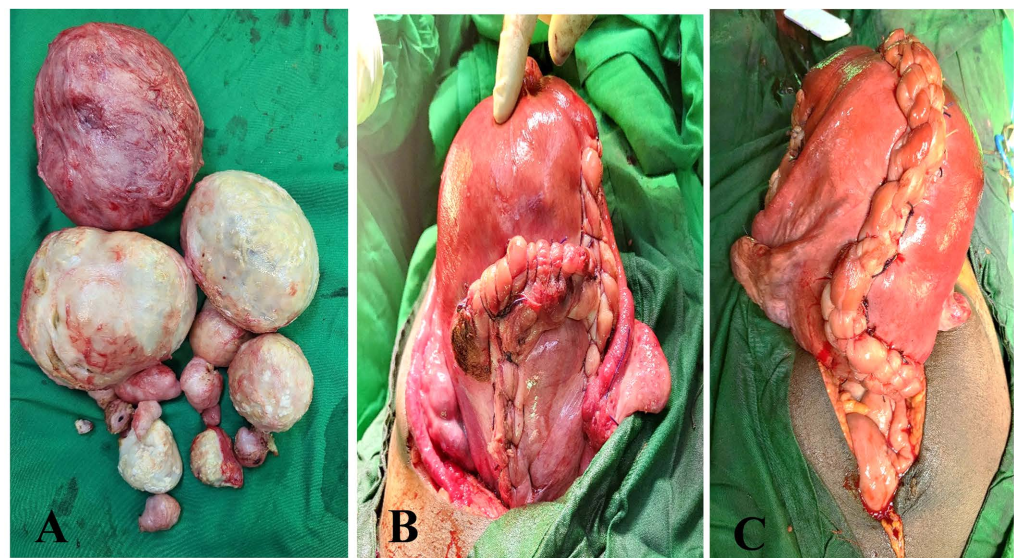
(a)



C: Exposure of the left iliac vessel sheath. IC: Left common iliac artery. E: Left external iliac artery. I: Left internal iliac artery. D: Left iliac vessels. *: Ligated left internal iliac artery. S: Sigmoid. U: Left ureter.

(b)

Figure 3. (a) ligation of the right internal or hypogastric iliac artery (superior view). (b) left iliac vessels and their anatomical relationship (superior view).



A: Myxomatous nuclei. B: Uterus with hysterorrhaphy after polymyomectomy and cesarean section (anterior view). C: Uterus with hysterorrhaphy after polymyomectomy (posterior view).

Figure 4. Myomas and uterus after enucleation and hysterorrhaphy.

Polymyomectomy allowed the enucleation without invasiveness of the cavity of 16 nuclei, including five in aseptic necrobiosis. The largest nucleus measured approximately 10 cm in the major axis (Figure 4). Hysterorrhaphy, after uterine reduction of the posterosuperior face of the uterus and padding of the myomectomy compartments, was performed in two planes, first muscular by separated stitches

of BLAIR DONATI [16], then serous by a continuous suture of inverting stitches reinforced by U-shaped stitches, with VICRYL thread 4/1 and 5/2 (**Figure 4**).

The tourniquet was removed after one hour and 30 minutes. The procedure lasted two hours. No incidents were noted. The blood loss collected in the jar after intraoperative aspiration was 500 ml, including 350 ml related to the cesarean section before the tourniquet was applied.

The patient received a transfusion of three units of packed red blood cells.

The postoperative hemoglobin level was 7.8 g/dl.

The postoperative course was complicated by a fever of 38.5˚C for the first two days. Transit resumed on the third postoperative day, as did the first dressing. Discharge from the maternity ward was decided on the seventh day.

The death of the newborn occurred on the second day of life in the neonatology department.

3. Discussion

The first MC was described by Bonney more than a century ago [17] and has traditionally been discouraged in obstetrics textbooks [7] [18]. Nowadays, several schools agree on the performance of myomectomy during a cesarean section in the case of pedunculated sub-serosal myoma of the antero-inferior surface of the uterine body [3]-[12]. Furthermore, the presence of congenital or acquired coagulopathy, multiple, interstitial, fundal, cornual and posterior myomas are contraindications to MC [4]-[12]. On the other hand, many authors have reported the practice of polymyomectomy during cesarean section in the case of interstitial myomas of different sites [4] [5] [7] [9] [10] [19]. Song D, in a meta-analysis of nine case-control studies on myomectomy during cesarean section and comparing women with myxomatous uteri who underwent MC and those who underwent cesarean section only, noted in several cases that polymyomectomy for myomas of different locations and types is possible without significantly increasing the risk of intraoperative bleeding and hemorrhagic complications [7].

The reduction of the risk of hemorrhage during myomectomy has been the subject of numerous studies in which several procedures have been studied, including intravenous or intramural injection of Oxytocin, the isthmic tourniquet or tourniquet, vascular ligatures (uterine arteries, hypogastric arteries) [5] [7] [20]-[25].

Several authors have suggested, in cases of sub-serosal and interstitial myomas, the injection of diluted Oxytocin into the pseudo-capsule of the myoma [4] [26]. Furthermore, the injection of diluted vasopressin solutions directly into the myomas, raising a circumferential papule to induce a vascular spasm and muscle contraction, is an effective alternative to tourniquet techniques [27]. As for the tourniquet, several authors have experimented with it in myomectomy in the case of a non-pregnant uterus and recommend its use. Indeed, it allows for to reduction of the flow of the uterine arteries and consequently reduces blood loss [20]-[23]. Another advantage associated with the use of the tourniquet technique is that it offers a clearer operating field, facilitating the complete enucleation of the myomas

and possibly reducing the operating time [26].

A prospective randomized study conducted by Sapmaz [28] on intra-operative and postoperative blood loss during MC, compared the effects of bilateral ascending uterine artery ligation and tourniquet in 52 patients divided into two equal groups. One of the patients in the tourniquet group had a postoperative hemorrhage, requiring emergency laparotomy and bilateral internal iliac artery ligation. Although intraoperative blood loss was similar between groups, the authors concluded that arterial ligation may be a better method, as it continues to be effective after surgery.

Thus, to reduce intraoperative blood loss and limit the risk of postpartum hemorrhage, we opted for bilateral hypogastric artery ligation associated with a segmental tourniquet.

Many authors have noted several benefits of MC. MC represents an alternative to corporeal cesarean section in cases of anterior segmental and corporeal myomas [13]. In addition, after delivery, the uterus is better able to control hemorrhages, due to its contractions and puerperal involution. Furthermore, suturing is easier in a pregnant uterus than in a non-pregnant uterus due to its increased elasticity and reduced fragility [7] [18]. Indeed, the hypertrophic muscle fibers of the pregnant uterus contract more strongly, ligating the blood vessels, and this is even more so after the administration of uterotonics in cases of MC. Also, myomectomy is technically easier on a pregnant uterus due to the greater thickness of the pseudo-capsule of the myoma [13]. Possible long-term benefits of MC include improvement of symptoms and quality of life, elimination of risks and costs of surgical interventions and repeated anesthesia [13]. Similarly, MC avoids complications of myoma during the puerperium and in subsequent pregnancies [29]. Some researchers claim that the quality of the scar after MC is better than that after interval myomectomy, which is related to an activation of the immune system during pregnancy [18]. On the other hand, MC would increase the risk of hemorrhage and hysterectomy for hemostasis for intramural myomas. In addition, posterior myomectomies would be associated with a high risk of utero-adnexal adhesions that can compromise subsequent fertility [12]-[14]. The evaluation of the long-term consequences of these intraoperative preventive hemostasis techniques on subsequent fertility has not been performed; thus, it may constitute a limitation in our study. Nevertheless, according to several authors, fertility seems to be maintained after their use [30] [31], with a resumption of menstruation within an average of 2.5 months in non-breastfeeding women and an average pregnancy time of 44 months [32]. In addition, data from the literature describe several pregnancies after ligation of the internal iliac arteries, most from the Nizard series [33], the others from isolated cases reported in the literature [34] [35].

Regarding the duration of the operation, it was far longer than the usual duration of cesarean section in our institution, which is 30 to 60 minutes, thus corroborating the results reported by other authors [3]-[5] [7] [26].

Postoperatively, in several series, variations in hemoglobin levels and the percentage of blood transfusion were not significantly observed in cases of MC [3]-[5] [7] compared with cesarean section alone. On the other hand, the hospital stay of patients was prolonged in cases of MC [3]-[5] [7]. Our patient stayed seven days after MC, far longer than the four or even five days generally in cases of cesarean section alone. The postoperative course was complicated by fever for the first two days, certainly related to the polymyomectomy, as reported in the literature [1] [20] [23].

Thus, these data challenge the beliefs of many obstetricians regarding myomectomies during the cesarean section. However, it is necessary to precisely define the indications for such an intervention.

4. Conclusion

With an increased incidence of myomas during cesarean section, the risk-benefit ratio of myomectomy during cesarean section needs to be properly reassessed in the future. Although several studies report the safety and feasibility of myomectomy during cesarean section, these studies nevertheless remain studies with a low level of scientific evidence for the most part. Furthermore, although the use of tourniquets and vascular ligation have shown their effectiveness in reducing blood loss and blood transfusion, they need to be evaluated for their long-term consequences on subsequent fertility and pregnancy outcomes.

Conflicts of Interest

The authors declare no conflicts of interest.

Ethical Aspects

Informed consent was obtained from the pregnant woman's partner and her parents for the polymyomectomy to be performed during the cesarean section after an explanation of the benefits and risks associated with the surgery and the different intraoperative hemostasis techniques.

References

[1] Fernandez, H., Gervaise, A. and de Tayrac, R. (2002) Fibromes Utérins. Encycl Méd Chir (Editions Scientifiques et Médicales Elsevier SAS, Paris, tous droits réservés), Gynécologie, 570-A-10, 11 p.

[2] Goodman, L.R., Valentine, L.N. and Falcone, T. (2014) Myoma in Pregnancy. In: Tinelli, A. and Malvasi, A., Eds., *Uterine Myoma*, *Myomectomy and Minimally Invasive Treatments*, Springer International Publishing, 219-236. https://doi.org/10.1007/978-3-319-10305-1_15

[3] Goyal, M., Dawood, A.S., Elbohoty, S.B., Abbas, A.M., Singh, P., Melana, N., *et al*. (2021) Cesarean Myomectomy in the Last Ten Years; a True Shift from Contraindication to Indication: A Systematic Review and Meta-Analysis. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, **256**, 145-157. https://doi.org/10.1016/j.ejogrb.2020.11.008

[4] Zhao, R., Wang, X., Zou, L. and Zhang, W. (2019) Outcomes of Myomectomy at the Time of Cesarean Section among Pregnant Women with Uterine Fibroids: A Retrospective Cohort Study. *BioMed Research International*, **2019**, Article ID: 7576934. https://doi.org/10.1155/2019/7576934

[5] Akkurt, M.O., Yavuz, A., Eris Yalcin, S., Akkurt, I., Turan, O.T., Yalcin, Y., *et al.* (2016) Can We Consider Cesarean Myomectomy as a Safe Procedure without Long-Term Outcome? *The Journal of Maternal-Fetal & Neonatal Medicine*, **30**, 1855-1860. https://doi.org/10.1080/14767058.2016.1228057

[6] Lee, H.J., Norwitz, E.R. and Shaw, J. (2010) Contemporary Management of Fibroids in Pregnancy. *Reviews in Obstetrics and Gynecology*, **3**, 20-27.

[7] Song, D., Zhang, W., Chames, M.C. and Guo, J. (2013) Myomectomy during Cesarean Delivery. *International Journal of Gynecology & Obstetrics*, **121**, 208-213. https://doi.org/10.1016/j.ijgo.2013.01.021

[8] Stout, M.J., Odibo, A.O., Graseck, A.S., Macones, G.A., Crane, J.P. and Cahill, A.G. (2010) Leiomyomas at Routine Second-Trimester Ultrasound Examination and Adverse Obstetric Outcomes. *Obstetrics & Gynecology*, **116**, 1056-1063. https://doi.org/10.1097/aog.0b013e3181f7496d

[9] Milazzo, G.N., Catalano, A., Badia, V., Mallozzi, M. and Caserta, D. (2017) Myoma and Myomectomy: Poor Evidence Concern in Pregnancy. *Journal of Obstetrics and Gynaecology Research*, **43**, 1789-1804. https://doi.org/10.1111/jog.13437

[10] Baby, H.A., Begum, M.R., Ehsan, M., Ehsan, N., Amin, I., Chowdhury, A.A., *et al.* (2016) Myomectomy during Caesarean Section: Safety and Feasibility of the Procedure. *Bangladesh Journal of Obstetrics & Gynaecology*, **30**, 10-14. https://doi.org/10.3329/bjog.v30i1.30500

[11] Pergialiotis, V., Sinanidis, I., Louloudis, I., Vichos, T., Perrea, D.N. and Doumouchtsis, S.K. (2017) Perioperative Complications of Cesarean Delivery Myomectomy. *Obstetrics & Gynecology*, **130**, 1295-1303. https://doi.org/10.1097/aog.0000000000002342

[12] Sparić, R., Malvasi, A. and Tinelli, A. (2015) Analysis of Clinical, Biological and Obstetric Factors Influencing the Decision to Perform Cesarean Myomectomy. *Polish Gynaecology*, **86**, 40-45. https://doi.org/10.17772/gp/1897

[13] Sparic, R. (2014) Uterine Myomas in Pregnancy, Childbirth and Puerperium. *Srpski Arhiv za Celokupno Lekarstvo*, **142**, 118-124. https://doi.org/10.2298/sarh1402118s

[14] Hassiakos, D., Christopoulos, P., Vitoratos, N., Xarchoulakou, E., Vaggos, G. and Papadias, K. (2006) Myomectomy during Cesarean Section. *Annals of the New York Academy of Sciences*, **1092**, 408-413. https://doi.org/10.1196/annals.1365.038

[15] Bessis, R., Brignon, C. and Shneiderl (1976) Localisation placentaire échographique dans les in-sertions basses; difficultés: Le placenta migrateur Soirée échographique. *Gynecology and Obstetrics*, No. 5, 3751.

[16] Corgibet, F. (2019) Le point de Blair-Donati. *Dermato Mag*, **3**, 206-207.

[17] Bonney, V. (1914) Caesarean Myomectomy. Remarks on the Operation. *Proceedings of the Royal Society of Medicine*, **7**, 121-123.

[18] Malvasi, A., Stark, M. and Tinelli, A. (2014) Cesarean Myomectomy. In: Tinelli, A. and Malvasi, A., Eds., *Uterine Myoma*, *Myomectomy and Minimally Invasive Treatments*, Springer International Publishing, 237-252. https://doi.org/10.1007/978-3-319-10305-1_16

[19] Lee, C.E. and Mirosh, M. (2017) Myomectomie Pendant une Césarienne. *Journal of Obstetrics and Gynaecology Canada*, **39**, 316-348. https://doi.org/10.1016/j.jogc.2017.03.094

[20] Fanny, M., Fomba, M., Aka, E., Adjoussou, S., Olou, L., Koffi, A., *et al*. (2018) Prévention de l'hémorragie per myomectomie en Afrique subsaharienne: Apport du garrot sur l'isthme utérin. *Gynécologie Obstétrique Fertilité & Sénologie*, **46**, 681-685. https://doi.org/10.1016/j.gofs.2018.08.005

[21] Incognito, G.G., Gulino, F.A., Cianci, S., Occhipinti, S., Incognito, D., De Tommasi, O., *et al*. (2024) Minimizing Blood Loss in Laparotomic Myomectomy through the Tourniquet Use: Insights from Our Clinical Experience and Literature Review. *Surgeries*, **5**, 162-171. https://doi.org/10.3390/surgeries5020016

[22] Vilos, G.A., Allaire, C., Laberge, P. and Leyland, N. (2016) Prise en charge des léiomyomes utérins. *Journal of Obstetrics and Gynaecology Canada*, **38**, S550-S576. https://doi.org/10.1016/j.jogc.2016.09.063

[23] Itoua, C., Eouani, E.M.L., Ambeto, F.S.O., Mpia, N.S.B.P., Mpia, N.S.B.P., Koko, P.S., *et al*. (2018) Contribution of the Tourniquet in the Prevention of Haemorrhages during Myomectomies at the University Hospital of Brazzaville. *Open Journal of Obstetrics and Gynecology*, **8**, 701-706. https://doi.org/10.4236/ojog.2018.88074

[24] Akbas, M., Mihmanli, V., Bulut, B., Temel Yuksel, I., Karahisar, G. and Demirayak, G. (2016) Myomectomy for Intramural Fibroids during Caesarean Section: A Therapeutic Dilemma. *Journal of Obstetrics and Gynaecology*, **37**, 141-145. https://doi.org/10.1080/01443615.2016.1229272

[25] Lin, J., Lee, W., Wang, P., Lai, M., Chang, W. and Liu, W. (2010) Uterine Artery Occlusion and Myomectomy for Treatment of Pregnant Women with Uterine Leiomyomas Who Are Undergoing Cesarean Section. *Journal of Obstetrics and Gynaecology Research*, **36**, 284-290. https://doi.org/10.1111/j.1447-0756.2009.01158.x

[26] Sparić, R., Malvasi, A., Kadija, S., Babović, I., Nejković, L. and Tinelli, A. (2016) Cesarean Myomectomy Trends and Controversies: An Appraisal. *The Journal of Maternal-Fetal & Neonatal Medicine*, **30**, 1114-1123. https://doi.org/10.1080/14767058.2016.1205024

[27] Samy, A., Raslan, A.N., Talaat, B., El Lithy, A., El Sharkawy, M., Sharaf, M.F., *et al*. (2020) Perioperative Nonhormonal Pharmacological Interventions for Bleeding Reduction during Open and Minimally Invasive Myomectomy: A Systematic Review and Network Meta-Analysis. *Fertility and Sterility*, **113**, 224-233.e6. https://doi.org/10.1016/j.fertnstert.2019.09.016

[28] Sapmaz, E., Celik, H. and Altungul, A. (2003) Bilateral Ascending Uterine Artery Ligation vs. Tourniquet Use for Hemostasis in Cesarean Myomectomy. A Comparison. *Journal of Reproductive Medicine*, **48**, 950-954.

[29] Liu, W., Wang, P., Tang, W., Wang, I. and Tzeng, C. (2006) Uterine Artery Ligation for Treatment of Pregnant Women with Uterine Leiomyomas Who Are Undergoing Cesarean Section. *Fertility and Sterility*, **86**, 423-428. https://doi.org/10.1016/j.fertnstert.2006.01.027

[30] Descargues, G., *et al*. (2004) Menses, Fertility and Pregnancy after Arterial Embolization for the Control of Postpartum Haemorrhage. *Human Reproduction*, **19**, 339-343. https://doi.org/10.1093/humrep/deh082

[31] Eriksson, L., Mulic-Lutvica, A., Jangland, L. and Nyman, R. (2007) Massive Postpartum Hemorrhage Treated with Transcatheter Arterial Embolization: Technical Aspects and Long-Term Effects on Fertility and Menstrual Cycle. *Acta Radiologica*, **48**, 635-642. https://doi.org/10.1080/02841850701370683

[32] Capmas, P., Picone, O., Musset, D., Frydman, R. and Fernandez, H. (2012) Fertilité et grossesses après prise en charge invasive des hémorragies du postpartum. *Journal de Gynécologie Obstétrique et Biologie de la Reproduction*, **41**, 298-306.

https://doi.org/10.1016/j.jgyn.2012.01.001

[33] Nizard, J., *et al*. (2003) Fertility and Pregnancy Outcomes Following Hypogastric Artery Ligation for Severe Post-Partum Haemorrhage. *Human Reproduction*, **18**, 844-848. https://doi.org/10.1093/humrep/deg161

[34] Chauleur, C., Fanget, C., Tourne, G., Levy, R., Larchez, C. and Seffert, P. (2008) Serious Primary Post-Partum Hemorrhage, Arterial Embolization and Future Fertility: A Retrospective Study of 46 Cases. *Human Reproduction*, **23**, 1553-1559. https://doi.org/10.1093/humrep/den122

[35] Sentilhes, L., Trichot, C., Resch, B., Sergent, F., Roman, H., Marpeau, L., *et al*. (2008) Fertility and Pregnancy Outcomes Following Uterine Devascularization for Severe Postpartum Haemorrhage. *Human Reproduction*, **23**, 1087-1092. https://doi.org/10.1093/humrep/den049