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Treatment of adnexal torsion using operative laparoscopy

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The aim of this work was to clarify the value and application of operative laparoscopic treatment for adnexal torsion. We included in our study all patients (n = 27) who presented with an intra-operative diagnosis of torsion of the adnexa between January 1989 and May 1995. A total of 28 adnexal torsions were treated. Treatment was carried out by laparoscopic surgery in 75% of cases (21 torsions); in one-half of the cases (14 torsions) it was possible to achieve conservative laparoscopic treatment. The nature of the lesions and the experience of the surgeons are two factors which closely govern the outcome of surgical treatment. For those patients presenting a benign pathology, laparoscopic surgery was used to treat 84% of cases in the series. All the patients presenting a benign pathology and operated upon since 1993 have received laparoscopic surgical treatment. No major complications (peritonitis, thrombotic emboli, coagulation problems) were observed after conservative laparoscopic surgery. These results demonstrate that, provided the surgeons are sufficiently experienced, treatment by conservative laparoscopic surgery for adnexal torsion is both safe and reliable. In the years to come more work must be done to assess the vitality of the adnexa so that as many patients as possible can benefit from conservative treatment.

Key words: adnexal torsion/conservative treatment/operative laparoscopy

Introduction

Adnexal torsion is a pathology that is not encountered very frequently, but which usually occurs during the sexually active period of life (Lee and Welch, 1967; Haskins and Shull, 1986). It is difficult to diagnose because although adnexal torsion may present in the form of acute pelvic pain (Lomano *et al.*, 1970; Bider *et al.*, 1991; Bayer and Wiskind, 1994), the symptoms can sometimes be deceptive. When the lesions are asymptomatic (Sebastian *et al.*, 1973; Georgy and Viechnicki, 1974; Nissen *et al.*, 1977), the diagnosis may be made only during the surgical procedure. Although conservative treatment was suggested by Way as early as 1946, adnexectomy without detorsion was the operation of reference for a very long time, so avoiding the potential complication of thrombotic emboli from the ovarian vein (Hibbard, 1985; Wagaman and Williams, 1990). For a long time treatment was carried out by laparotomy (McGowan, 1964; Lee and Welch, 1967; Lomano *et al.*, 1970; Zweizig *et al.*, 1993), but progress made in operative laparoscopy now means that for certain indications the treatment can be carried out via laparoscopy (Mage *et al.*, 1989; Reich *et al.*, 1992; Oelsner *et al.*, 1993; Shalev and Peleg, 1993; Iwabe *et al.*, 1994).

This work deliberately focuses on the treatment of this pathology and is based on a retrospective series of 28 adnexal torsions, so as to clarify the status and outcome of laparoscopic surgery for this indication.

Materials and methods

The patient

All patients with an intra-operative diagnosis of torsion of the adnexa over a 6.5 year period were reviewed. From 1 January 1989 to 31 May 1995, 27 patients presenting with an adnexal torsion were operated upon in our department (Clinique Universitaire Baudelocque, CHU Cochin Port-Royal, Paris, France). The mean age of the patients was 31.0 ± 9.7 years (range 18–61). The mean parity was 0.81 ± 1.03 (range 0–3). Of the 27 patients, 15 (55.6%) were nulliparous. One patient (64 years of age) was post-menopausal for 13 years without hormone replacement therapy and two patients were in the peri-menopausal period (47 and 49 years old). Previous surgical histories for these patients were as follows: simple appendectomy (seven patients; 25.9%), cholecystectomy (one patient; 3.7%), laparoscopic salpingectomy (one patient; 3.7%), bilateral cystectomy and tubal sterilization via Pfannenstiel incision (one patient; 3.7%).

In all, 23 patients (85.2%) were of child-bearing age. Indeed, four (17.4%) were in the first trimester of pregnancy, one (4.3%) had given birth 15 days previously and one (4.3%) was in her fifth cycle of ovulation stimulation (clomiphene citrate and gonadotrophins). Another four patients (17.4%) were following a progestogen treatment regime and one patient (4.3%) was using oestro-progestogen contraception. The remaining 12 patients (52.2%) were under no treatment at all. Two (50.0%) of the four pregnancies occurred spontaneously: one of these was an intra-uterine pregnancy at 6 weeks of amenorrhoea and another was an extra-uterine pregnancy at 8 weeks of amenorrhoea. The two other pregnancies were obtained by ovarian stimulation. One patient conceived after ovulation induction (Clomid and gonadotrophins) and had a mono-embryonic pregnancy now at 7 weeks of amenorrhoea, with grade II [World Health Organization, 1973 (WHO) grade] hyperstimulation. The second pregnancy resulted from in-vitro fertilization (IVF), and was a twin pregnancy now at 6 weeks of amenorrhoea with a grade II (WHO, 1973) hyperstimulation syndrome.

Treatment

Surgical treatment was carried out by either laparotomy or laparoscopy. The first step in the operation was to confirm the diagnosis and

Table I. Per-operative appearance of the adnexa according to the clinical form (n = 21)

			Acute form		Sub-acute form		Asymptomatic form	
	n	%	n	%	n	%	n	%
Necrosis	4	19.0	2	50.0	2	50.0	0	0.0
Ischaemia	9	42.9	8	88.9	0	0.0	1	11.1
Normal	8	38.1	1	12.5	4	50.0	3	37.5
Total	21	100.0	11	52.4	6	28.6	4	19.0

specify which organs (tube, ovary or both) were involved in the torsion as well as the number of turns. Subsequently there were two further phases. The first of these was to untwist the adnexa and assess the potential for recovery of the tissues. Patients were then assigned to three groups according to a classification published previously (Mage *et al.*, 1989): group 1, no evidence of ischaemia or mild lesions with immediate and complete recovery; group 2, severe ischaemic lesions with partial recovery 10 min after detorsion; and group 3, necrotic adnexa without recovery. The second phase in the operation was to treat the aetiology of the torsion (ovarian cyst, extra-uterine pregnancy, etc.). When the operation used laparoscopic surgery, treatment was carried out according to methods which have already been well established: puncture biopsy of the functional ovarian cysts; conservative (cystectomy) or radical treatment (adnexectomy) for organic ovarian cysts (Dubuisson *et al.*, 1992; Nezhat *et al.*, 1992; Parker, 1992; Canis *et al.*, 1994); or radical treatment of an extra-uterine pregnancy (Dubuisson *et al.*, 1987). In the case of ovarian cysts, any suspicion of neoplastic pathology during the diagnostic part of the laparoscopy required immediate conversion to laparotomy. When necessary, adhesiolysis was effected. Conservative treatment was used whenever ischaemic lesions were minimal and/or there were obvious signs after detorsion that the adnexa was recovering. On the other hand, adnexectomy was carried out when the adnexa was necrotic and/or there was no recovery after detorsion. No patient was given anti-coagulation treatment post-operatively.

Results

One of the 27 patients (3.7%) presented bilateral torsion of the adnexa, so the total number of adnexal torsions treated in this series was 28. The mean size of adnexa measured at pre-operative endovaginal ultrasonography was 7.75 ± 3.80 cm (range 3–16).

The macroscopic appearance of the adnexa (necrotic, ischaemic, slightly affected or normal) was clearly stated in only 75% of the operation reports (21 torsions). The per-operative appearance according to clinical form is reported in Table I. The mean number of turns was 2.14 ± 1.06 turns (range 1–4).

Treatment was carried out by laparotomy in 25% of cases (seven torsions). The mean size of the adnexa treated by laparotomy was 10.3 ± 3.6 cm (range 5–15). The indications for laparotomy were as follows: suspicion of ovarian cancer (one case); conversion to laparotomy because of a suspicion of ovarian malignancy during the diagnostic phase of the laparoscopy (two cases); size of the adnexal masses (three cases: 10, 15 and 15 cm); and large haemoperitoneum (one case). Treatment by laparotomy was radical in 85.7% of cases (six patients). In three cases adnexectomy was decided because the adnexa appeared necrotic. In three other cases radical treatment was applied because of the suspicion of a neoplastic ovarian pathology. For these three patients the suspicions were proved to be well founded at pathological examination. The remaining patient treated by laparotomy was given a cystectomy with a partial salpingectomy.

Laparoscopic surgery was used to treat 75% of cases (21 torsions). The mean size of the adnexa treated by laparoscopy was 6.9 ± 3.5 cm (range 3–16). Laparoscopic treatment was radical in 33.3% of cases (seven torsions). In two cases unilateral adnexectomy was carried out. In the first case the adnexa was necrotic, and in the second the diagnostic part of the laparoscopy had given rise to suspicions of ovarian malignancy limited to the ovary. For this patient we carried out adnexectomy without opening the cyst and extracted the adnexa using an endoscopic bag (Chapron *et al.*, 1994) without any peritoneal nor parietal contamination. The frozen section examinations indicated a benign serous ovarian cyst, and this was confirmed by the final histological study. In one case bilateral adnexectomy was motivated by a non-suspicious post-menopausal ovarian cyst (Shalev *et al.*, 1994). Three cases received salpingectomy: two of these were for a twisted hydrosalpinx and one for a patient with a fissured extra-uterine pregnancy. Finally, in one case we employed i.p. cystectomy and salpingectomy in a 39 year old patient presenting a twisted paratubal cyst and who desired a tubal sterilization. Laparoscopic treatment was conservative in 66.7% of cases (14 torsions). The following procedures were used: simple detorsion (two cases), puncture biopsy of a functional ovarian cyst followed by detorsion (three cases) and detorsion followed by i.p. cystectomy for an organic ovarian cyst (nine cases).

The categorization of the operations (laparoscopy or laparotomy; conservative or radical) according to the appearance of the adnexa is presented in Table II. The classification of the operation according to the surgeon's experience and the histological nature of the lesions is given in Table III. The number of patients who underwent laparoscopic surgical treatment is indeed correlated with the experience of the surgeon. These results are even more clear-cut if the three patients presenting with a malignant ovarian lesion, and consequently a formal indication for treatment by laparotomy, are excluded. The data then show that for those patients with a benign pathology operated upon until 1992, the rate of treatment by laparotomy was 36.4% (four torsions), and this rate drops to zero for patients operated upon since the beginning of 1993 (Table III). At the same time as the rate of laparoscopic treatment increased, our greater experience enabled the rate of conservative laparoscopic treatment to rise. The rate of conservative laparoscopic treatment for patients presenting

Table II. Categorization of the operation according to appearance of the adnexa (n = 21)

Appearance of the adnexa	n	Laparoscopic surgery				Laparotomy			
		Conservative		Radical		Conservative		Radical	
		n	%	n	%	n	%	n	%
Normal	8	7	87.5	0	0.0	0	0.0	1	12.5
Ischaemic	9	5	55.6	3	33.3	0	0.0	1	11.1
Subtotal	17	12	70.6	3	17.6	0	0.0	2	11.8
Necrotic	4	0	0.0	1	25.0	0	0.0	3	75.0
Total	21	12	57.1	4	19.1	0	0.0	5	23.8

Table III. Adnexal torsions: surgical procedures

Year	n	Laparoscopic surgery				Laparotomy			
		Conservative		Radical		Conservative		Radical	
		n	%	n	%	n	%	n	%
For all patients (n = 28)									
Until 1992	12	5	41.7	2	16.7	1	8.3	4	33.3
Since 1993	16	9	56.3	5	31.3	0	0.0	2	12.5
Total	28	14	50.0	7	25.0	1	3.6	6	21.4
For patients presenting a benign pathology (n = 25)									
Until 1992	11	5	45.5	2	18.2	1	9.1	3	27.3
Since 1993	14	9	64.3	5	35.7	0	0.0	0	0.0
Total	25	14	56.0	7	28.0	1	4.0	3	12.0

Table IV. Adnexal torsions: pathological findings

Pathological findings	References[a]						
	A (n = 59)	B (n = 101)	C (n = 35)	D (n = 128)	E (n = 135)	F (n = 94)	G (n = 26)
Functional ovarian cyst	27.0	46.0	11.4	5.4	26.0	13.0	15.4
Cystadenoma (serous or mucinous)	15.0	4.0	–	14.0	17.0	14.0	11.5
Dermoid cysts	10.0	8.0	–	30.0	13.0	19.0	11.5
Fibroma/thecoma	1.6	3.0	–	3.1	7.0	4.3	3.9
Endometriomas	0.0	0.0	–	1.5	1.5	0.0	0.0
Neoplasmas	3.3	2.0	–	1.5	14.8	0.0	11.5
Organic ovarian pathologies	30.5	17.0	25.7	54.5	54.8	37.3	38.5
Para-ovarian cysts	5.0	5.0	34.3	18.5	7.0	21.0	23.1
Hydrosalpinx	3.3	0.0	0.0	2.3	2.0	0.0	7.7
Ectopic pregnancies	0.0	0.0	5.7	0.8	2.0	0.0	3.9
Normal adnexa	0.0	10.0	14.3	18.0	5.0	0.0	0.0
Impossible histology	27.0	–	–	–	–	23.4	11.5

[a]A = Bayer and Wiskind (1994); B = Bider *et al.* (1991); C = Mage *et al.* (1989); D = Hibbard (1985); E = Lee and Welch (1967); F = Zweizig *et al.* (1993); G = our study.

with a benign pathology and operated upon until 1992 was 45.5% (five torsions), compared with a rate of 64.3% (nine torsions) for patients operated upon since the beginning of 1993 (Table III).

The histological results studied for 26 cases, because two torsions which occurred in a context of hyperstimulation were treated by simple detorsion, are presented in Table IV.

The mean duration of the operation for the whole series was 66.5 ± 33.8 min (range 20–150). The time taken for laparoscopy was slightly less than that for laparotomy, with 59.7 ± 33.2 (range 20–135) and 85.7 ± 29.8 min (range 65–150) (P = not significant) respectively. No per-operative complications were observed and the post-operative history was uncomplicated. We encountered no major post-operative complications, and notably no thrombotic emboli complications. Only one patient required complementary treatment. This was the patient operated upon as an emergency who had a large haemoperitoneum (2 l) and who needed a blood transfusion. Four patients had a slight fever after the operation, between 38.0 and 38.5°C, which regressed in <48 h under antibiotic treatment; the adnexa was necrotic in three of these patients and there were ischaemic lesions in the other case. The mean duration of the hospital stay for the whole series was 3.1 ± 1.6 days (range 2–7). The hospital stay after laparoscopy was less than that after laparotomy, being 2.4 ± 0.7 (range 2–5) and 5.1 ± 1.5 days (range 3–7) ($P < 0.001$) respectively.

Table V. Adnexal torsions: status and approach of conservative treatment

Authors	Year	n	Conservative treatment		Conservative treatment via laparoscopy	
			n	%	n	%
Lomano *et al.*	1970	44	6	13.6	0	0.0
Hibbard	1985	128	9	7.0	0	0.0
Mage *et al.*	1989	35	27	77.1	22	62.8
Bider *et al.*	1991	101	62	62.4	–	–
Reich *et al.*	1992	8	8	100.0	8	100.0
Oelsner *et al.*	1993	40	10	100.0	14	35.0
Shalev and Peleg	1993	41	38	92.7	38	92.7
Zweizig *et al.*	1993	94	61	65.0	0	0.0
Bayer and Wiskind	1994	59	1	1.7	–	–
Present study	1995	28	14	50.0	14	50.0

As for the three patients presenting with an intra-uterine pregnancy at the time of the operation, the situation evolved as follows. One patient requested a therapeutic abortion 1 week later, while the other two patients, one of whom had a twin pregnancy, had perfectly normal pregnancies with term delivery.

Only one recurrence was observed in this series. This was the patient with a twin pregnancy obtained by IVF and who, after 6 weeks of amenorrhoea, had presented an adnexal torsion in a context of hyperstimulation grade II (WHO, 1973). She had been treated by laparoscopic surgery with simple detorsion (one turn). Some 3 weeks later the patient again suffered acute abdominal pain, and an ultrasound examination revealed a large 7 cm ovarian cyst. In view of the functional nature of the cyst, during the second laparoscopy we untwisted the adnexa (two turns) and then carried out a puncture biopsy of the cyst.

Discussion

Adnexal torsion is a rare pathology which usually occurs during the sexually active period of life. The classic situation is unilateral torsion involving a pathological adnexa, although cases of torsion have been observed on normal adnexa (Lee and Welch, 1967; Hibbard, 1985; Mage *et al.*, 1989; Bider *et al.*, 1991). Way was the first to demonstrate, back in 1946 with a series of 15 patients, that it is possible to carry out conservative surgical treatment for adnexal torsion. However, the possibility of thrombotic emboli complications secondary to detorsion and the hypothetical risk of peritonitis were some of the reasons why radical treatment remained the treatment of reference up until the end of the 1980s (McGowan, 1964; Lee and Welch, 1967; Lomano *et al.*, 1970; Hibbard, 1985). More recently, Zweizig *et al.* (1993) compared the post-operative morbidity after radical or conservative treatment via laparotomy, and demonstrated that there was no statistically significant difference between them. Even though one case of adnexal infarction after the conservative surgical management of torsion of a hyperstimulated ovary was reported recently (Pryor *et al.*, 1995), over the past few years several teams have presented their experience with the conservative treatment of adnexal torsion without any thrombotic emboli complications or severe infections being observed (Mage *et al.*, 1989; Reich *et al.*, 1992; Oelsner *et al.*, 1993; Shalev and Peleg, 1993; Iwabe *et al.*, 1994). These results match our own because no major complication arose in our series for patients who were given conservative treatment.

These observations have enabled us to state that the feasibility and reliability of conservative treatment for adnexal torsion have now been definitely established. The progress made recently in laparoscopic surgery brings with it the question as to the best forum for this conservative treatment. For the whole of our series, we were able to use laparoscopic surgery to treat 75% of cases (21 patients), and 50% of the patients (14 adnexal torsions) benefited from conservative laparoscopic treatment (Table III). These overall results are similar to those of Mage *et al.* (1989) who, with a series comparable with our own, reported a 77.0% rate of laparoscopic surgical treatment (27 patients) and a 62.8% rate of laparoscopic conservative treatment (22 patients). The nature of the lesions is the decisive factor for the type of surgical treatment. If we exclude the three patients presenting with a malignant ovarian mass for whom we justifiably used laparotomy, 84.0% of the patients (21 cases) with a benign adnexal pathology were treated using laparoscopic surgery (Table III). The percentage of laparoscopic surgical treatment increases with the experience of the surgeons. Whereas before 1993 only 63.6% of patients (seven cases) with a benign pathology were treated via laparoscopy, all the patients (14 cases; 100%) since 1993 who presented with an adnexal torsion in a benign context have been able to benefit from this type of treatment (Table III). The usage of conservative laparoscopic surgical treatment is also correlated with the experience of the surgeons. Whereas before 1993 the rate of conservative laparoscopic surgical treatment was only 45.4% (five cases), this rate reached 64.3% (nine cases) after 1993. In the literature, the rate of conservative laparoscopic treatment is very variable (from 0 to 100%; Table V).

Conservative laparoscopic surgical treatment of adnexal torsion comprises two main phases. The first consists of untwisting the adnexa to assess how well the ischaemic tissues are likely to recover. The second phase is to treat the aetiology. This treatment can help to maintain the patient's fertility, as Shalev and Peleg (1993) reported that 73% of patients desiring pregnancy had become pregnant within 12 months after the conservative laparoscopic treatment of adnexal torsion. So the most important question we must answer for a patient presenting with adnexal torsion in a benign context and who desires pregnancy is whether she can be offered conservative

laparoscopic surgical treatment or not. It is generally agreed that patients with normal or only mildly ischaemic adnexa can be given simple detorsion followed by treatment of the aetiology. However, it is far more difficult to decide in situations when the adnexa present severe ischaemic or necrotic lesions. In these situations the recommended procedure varies according to the author. Zweizig *et al.* (1993) have proposed that if the adnexa appears necrotic, then this justifies adnexectomy from the outset without any prior detorsion. Mage *et al.* (1989) recommend untwisting in all cases and only carrying out radical treatment if the adnexa shows no sign of recovering its normal colour after 10 min. Others such as Oelsner *et al.* (1993), believing that it is impossible to judge from the per-operative appearance whether the lesions are reversible or not (Hibbard, 1985; McHutchinson *et al.*, 1993; Bayer and Wiskind, 1994), suggest using conservative treatment even when the adnexa present apparently severe ischaemic lesions. The long-term results for this categorically conservative attitude seem to be encouraging because out of a series of 40 patients, for 37 of whom there was a mean follow-up of 4.07 years, 94.6% (35 patients) were found to present satisfactory follicular development at ultrasound examination. The six patients in this series who subsequently underwent a second operation (Caesarean section, four cases; laparoscopy for infertility work-up, two cases) presented a macroscopically normal adnexa with no adhesions. The post-operative history for all the patients in this series (Oelsner *et al.*, 1993) was uncomplicated, with no infections, no thrombotic emboli and no coagulation problems. These results are very much in favour of preservation of the adnexa even when the lesions are severe, and agree with those from other series (Mashiach *et al.*, 1990; Bider *et al.*, 1991; Shalev and Peleg, 1993). The use of colour Doppler (Desai *et al.*, 1994; Gordon *et al.*, 1994) or fluorescein (McHutchinson *et al.*, 1993) may help in future to select those adnexa which can be preserved.

Pathology results show that adnexal torsion is often associated with ovarian pathology, whether benign or malignant, organic or functional (Table IV). In our series (n = 26), ovarian pathology was observed in over half the patients (14 cases, 53.8%). In four cases (15.4%) functional cysts were present and in 10 cases (38.5%) there were organic ovarian cysts. Three of the organic cysts were neoplastic in nature. Adnexal torsion on a malignant cyst has been reported by other authors (Lee and Welch, 1967; Hibbard, 1985; Bider *et al.*, 1991; Bayer and Wiskind, 1994). The possibility that there may be a malignant cyst when dealing with adnexal torsion has very important consequences for surgical management. Even if the patients presenting with adnexal torsion are often operated upon as an emergency, whenever an ovarian cyst is responsible for the torsion the treatment must be carried out with the greatest of care. A pre-operative Doppler ultrasound examination must systematically look for signs of malignancy. In every case the first phase of the laparoscopy must be exclusively diagnostic. The slightest suspicion of a neoplastic ovarian pathology means that the therapeutic strategy must be reconsidered. If the suspicion of malignancy is strictly limited to the ovary, peritoneal cytology can be carried out to begin with, followed by laparoscopic adnexectomy without opening the cyst, which is removed inside an endoscopic bag to avoid any peritoneal or parietal contamination (Chapron *et al.*, 1994). The results of a frozen examination will indicate whether midline laparotomy during the same anaesthesia is necessary or not. In cases of extra-ovarian suspicious signs of malignancy, it is necessary to convert to laparotomy, as indeed we did twice in our series.

Conclusion

These results confirm that, provided the surgeon has specific training in this field, laparoscopic surgical treatment of adnexal torsion is perfectly feasible and reproducible. Laparoscopy is a very good approach for untwisting the torsion, assessing the whole of the abdomino–pelvic cavity and, if there is no suspicion of malignancy, treating the aetiology. The classification of surgical treatment is closely related to how early the diagnosis has been made, the surgeon's experience and the histological nature of the lesions which provoked the adnexal torsion. Although it appears feasible to propose conservative laparoscopic treatment even for lesions which seem very serious (necrosis), further research should be carried out to determine how to assess the vitality of the adnexa.

References

Bayer, A.I. and Wiskind, A.K. (1994) Adnexal torsion: can the adnexa be saved? *Am. J. Obstet. Gynecol.*, **171**, 1506–1511.

Bider, D., Mashiach, S., Dulitzky, M. *et al.* (1991) Clinical, surgical and pathologic findings of adnexal torsion in pregnant and non pregnant women. *Surg. Gynecol. Obstet.*, **173**, 363–366.

Canis, M., Mage, G., Pouly, J.L. *et al.* (1994) Laparoscopic diagnosis of adnexal cystic masses: a 12-years experience with long term follow-up. *Obstet. Gynecol.*, **83**, 707–712.

Chapron, C., Dubuisson, J.B., Fritel, X. *et al.* (1994) Techniques et indications de l'utilisation du sac endoscopique dans la prise en charge des kystes ovariens. *Contracept. Fertil. Sex.*, **22**, 682–684.

Desai, S.K., Allahbadia, G.N. and Datal, A. (1994) Ovarian torsion: diagnosis by color Doppler ultrasonography. *Obstet. Gynecol.*, **84**, 699–701.

Dubuisson, J.B., Aubriot, F.X. and Cardone, V. (1987) Laparoscopic salpingectomy for tubal pregnancy. *Fertil. Steril.*, **47**, 225–228.

Dubuisson, J.B., Meneux, E., Chapron, C. *et al.* (1992) Technique de la coeliochirurgie dans le traitement des kystes de l'ovaire. *Contracept. Fertil. Sex.*, **20**, 547–551.

Georgy, F.M. and Viechnicki, M.D. (1974) Absence of an ovary and uterine tube. *Obstet. Gynecol.*, **44**, 411–412.

Gordon, J.D., Hopkins, K.L., Jeffrey, R.B. and Giudice, L.C. (1994) Adnexal torsion: color Doppler diagnosis and laparoscopic treatment. *Fertil. Steril.*, **61**, 383–385.

Haskins, T. and Shull, B. (1986) Adnexal torsion: a mind-twisting diagnosis. *South. Med. J.*, **79**, 576–577.

Hibbard, L.T. (1985) Adnexal torsion. *Am. J. Obstet. Gynecol.*, **152**, 456–461.

Iwabe, T., Harada, T., Miura, H., Tuneaki, T. and Terakawa, N. (1994) Laparoscopic unwinding of adnexal torsion caused by ovarian hyperstimulation. *Hum. Reprod.*, **9**, 2350–2352.

Lee, R.A. and Welch, J.S. (1967) Torsion of the uterine adnexa. *Am. J. Obstet. Gynecol.*, **97**, 974–977.

Lomano, J.M., Trelford, J.P. and Allergy, J.C. (1970) Torsion of the uterine adnexa causing an acute abdomen. *Obstet. Gynecol.*, **35**, 221–225.

Mage, G., Canis, M., Manhes, H., Pouly, J.L. and Bruhat, M.A. (1989) Laparoscopic management of adnexal torsion. A review of 35 cases. *J. Reprod. Med.*, **34**, 520–524.

Mashiach, S., Bider, D., Moran, O., Goldenberg, M. and Ben-Rafael, Z. (1990) Adnexal torsion of hyperstimulated ovaries in pregnancies after gonadotrophin therapy. *Fertil. Steril.*, **53**, 76–80.

McGowan, L. (1964) Torsion of cystic or diseased adnexal tissue. *Am. J. Obstet. Gynecol.*, **88**, 135–136.

McHutchinson, B.L.L., Koonongs, P.P., Ballard, C.A. and D'Ablaing, G. (1993) Preservation of ovarian tissue in adnexal torsion with fluorescein. *Am. J. Obstet. Gynecol.*, **168,** 1386–1388.

Nezhat, F., Nezhat, C., Welanger, C.E. and Benigno, B. (1992) Four ovarian cancers diagnosed during laparoscopic management of 1011 women with adnexal masses. *Am. J. Obstet. Gynecol.*, **167,** 790–796.

Nissen, E.D., Kent, D.R. and Nissen, S.E. (1977) Unilateral tubo-ovarian auto amputation. *J. Reprod. Med.*, **19,** 151–153.

Oelsner, G., Bider, D., Goldenberg, M., Admon, D. and Mashiach, S. (1993) Long-term follow-up of the twisted ischemic adnexa managed by detorsion. *Fertil. Steril.*, **60,** 976–979.

Parker, W.H. (1992) Management of adnexal masses by operative laparoscopy. Selection criteria. *J. Reprod. Med.*, **37,** 603–606.

Pryor, R.A., Wiczyk, H.P. and O'Shea, D.L. (1995) Adnexal infarction after conservative surgical management of torsion of a hyperstimulated ovary. *Fertil. Steril.*, **63,** 1344–1346.

Reich, H., DeCaprio, J., McGlynn, F. and Taylor, P.J. (1992) Laparoscopic diagnosis and management of acute adnexal torsion. *Gynaecol. Endosc.*, **2,** 37–38.

Sebastian, J.A., Baker, R.C. and Corday, D. (1973) Asymptomatic infarction and separation of ovary and distal tubal uterine tubes. *Obstet. Gynecol.*, **41,** 531–535.

Shalev, E. and Peleg, D. (1993) Laparoscopic treatment of adnexal torsion. *Surg. Gynecol. Obstet.*, **176,** 448–450.

Shalev, E., Eliyahu, S., Pelg, D. and Tsabari, A. (1994) Laparoscopic management of adnexal cystic masses in postmenopausal women. *Obstet. Gynecol.*, **83,** 594–596.

Wagaman, R. and Williams, R. (1990) Conservative therapy for adnexal torsion. *J. Reprod. Med.*, **35,** 833–834.

Way, S. (1946) Ovarian cystectomy of twisted cysts. *Lancet*, **ii,** 47–48.

World Health Organization (1973) Agents stimulating gonadal function in human. *WHO Technol. Rep. Ser.*, **514.**

Zweizig, S., Perron, J., Grubb, D. and Mishell, D.R. (1993) Conservative management of adnexal torsion. *Am. J. Obstet. Gynecol.*, **168,** 1791–1795.

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