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PERCUTANEOUS MITRAL COMMISUROTOMY DURING PREGNANCY: 246 CASES

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Abstract

Objective:

This work aims at studying the indications and immediate to long term results of percutaneous mitral commisurotomy during pregnancy.

Methods:

A retrospective study of 246 mitral valve dilations performed during pregnancy from 1997 to 2018 in the Cardiology A department, Ibn Sina Teaching hospital Rabat.

We analyzed clinical, echocardiographic and hemodynamic data before and after PMC:

Results:

Our patients' mean age was 28 ± 5.2 years and the gestational age 28.1 ± 4 weeks of amenorrhea. Mitral stenosis was discovered during pregnancy in 40% of cases and all 246 patients were primiparous.

94% of our patients were symptomatic (NHYA stages III to IV). 85% of patients had sinus rhythm.

On cardiac ultrasound imaging, mitral stenosis was severe in all our patients: mean surface area of 0.8cm² and ≤ 1cm² in 85% of our cases; 90% of our patients had Wilkins' score of 8 – 9. Mean transvalvular gradient was high (21.4mmHg) and most of our patients had pulmonary hypertension (mean Pulmonary Artery systolic pressure 71mmHg).

The procedure had 98% success rate with immediate regression of symptoms to NYHA stages I to II in 95% cases.

After PMC, pregnancy reached full term in 95% of our patients with low fetal morbimortality and delivery in good conditions, mostly vaginal (85% of our cases).

Conclusion:

PMC is the ideal treatment for severe symptomatic mitral stenosis during pregnancy, yielding excellent results with very few complications. It leads to a clear regression of symptoms and improves hemodynamic parameters as well as pregnancy and delivery conditions.

When indicated, PMC should be performed in a reference centre.

Key words: mitral stenosis – pregnancy – Percutaneous mitral commisurotomy

INTRODUCTION

In developing countries, rheumatic disease accounts for half of cardiac complications during pregnancy; the leading cause being mitral stenosis (75%). {1}. Mitral stenosis is also the most frequently diagnosed valvulopathie during pregnancy (90%) {2}. It is poorly tolerated and accompanied by many materno-fetal complications.

The physiological modifications of circulatory hemodynamics during pregnancy is the essential decompensating factor in presence of mitral stenosis. In pregnant women with severe mitral stenosis, increase in blood volume, tachycardia and ventricular filling obstacle lead to post-capillary hypertension. This hemodynamic stress combined with other conditions can precipitate the onset of acute pulmonary oedema, cardiogenic choc, and ultimately unacceptable materno-fetal death.

Management of mitral stenosis during pregnancy should be pluridisciplinary (cardiologists, anesthesists, emergency physicians and obstetricians) in order to choose the best therapeutic option to allow pregnancy and delivery in good conditions.

PMC during pregnancy has been successfully tested with excellent results in the short and medium term. We share our experience with 246 patients who needed PMC during the second and third trimester from 1997 to 2018.

MATERIAL AND METHODS

In the cardiologie A department of Ibn Sina teaching hospital, Rabat, 4550 PMC were performed between 1986 and 2018. Our retrospective study focuses on 246 PMC performed during second and third trimester of pregnancy from 1997 to 2018.

Expecting mothers selected to undergo PMC only if they met the following clinical and echocardiographic criteria: severe mitral stenosis with surface area < 1.5cm², NYHA stage ≥2, absence of mitral regurgitation ≥ grade II, absence of left atrial or auricular thrombus, gestational age ≥ 20 weeks of amenorrhea.

Our methods of analysis were based on: patients' epidemiologic characteristics (age and gestational age), clinical information (mitral stenosis discovered during pregnancy, NHYA class and presence of signs of acute pulmonary oedema), and electric criteria (sinus rhythm of atrial fibrillation).

Doppler cardiac ultrasound examination was performed before and after the procedure for all patients. We carefully analyzed the severity of mitral stenosis, morphology of mitral apparatus and transmitral gradient. Mitral surface area was obtained by planimetry. Wilkins' score was calculated for all patients. Pulmonary artery systolic pressure was derived from tricuspid regurgitation flow. Transoesophageal echocardiography was systematically performed before PMC. During the procedure, the following hemodynamic data were monitored: mean pressure in left atrium, aortic pressure and left ventricle end-diastolic pressure (when possible).

Patients were clearly informed about the risks associated with this procedure and written consent was required of them. In order to limit radiation exposure during the procedure, we protected the abdomen with a lead shell. The procedure was sometimes performed in a left lateral decubitus position especially towards end of pregnancy in order to decompress the inferior vena cava). Scopy was used only when necessary; it was important to limit scopy time. A 6F pigtail catheter was place at the aortic root. We never had to use left ventriculography.

PMC was performed using Inoue's technique; trans-septal puncture of the left atrium was achieved using Brockenbrough's needle introduces through the left femoral vein. Heparin was administered after placing inoue's balloon in the left atrium. The balloon was progressively inflated until it reached a diameter that obliterated mitral imprint onscopy, at 30° right anterior oblique incidence. Mean transmitral gradient was measured before and after procedure by transthoracic echocardiography. Step-wise dilation was performed until transvalvular gradient fell below 5 mmHg except if a big V wave signaling significant mitral regurgitation appears. Mitral surface area and mitral regurgitation were evaluated by echocardiography after the procedure.

The procedure was considered successful if mitral surface area increased by 50% after the procedure, obtaining a mitral surface area ≥ 1.5cm² after procedure in the absence of significant mitral regurgitation. The results was considered suboptimal when a surface of ≥ 1.5cm² was achieved with occurrence of significant but not massive mitral regurgitation. Occurrence of massive surgical mitral regurgitation during the procedure was considered procedural failure.

All patients underwent obstetrical examination and follow-up, including abdominal and pelvic ultrasound san before and after the intervention. After PMC, patients underwent regular materno-fetal check-up.

Data was collected on a farm return pre-made form medical files. Data was treated by SPSS software.

RESULTS

Our work retrospectively studied 246 PMC during pregnancy performed from 1997 to 2018.

Our patients' mean age was 28 ± 5.2 years and the gestational age 28.1 ± 4 weeks of amenorrhea. Mitral stenosis was discovered during pregnancy in 40% of cases.

Functionally, 6% of our patients had NHYA stage II dyspnea, 70% stage III, and 24% stage IV. On the electric side, majority of our patients (85%) had sinus rhythm and the others (15%) had atrial fibrillation.

On cardiac ultrasound imaging, mitral stenosis was severe in all our patients:mean surface area of 0.8cm² (16% of our cases had very severe mitral stenosis with surface area ≤ 0.6cm²); 80% of our patients had Wilkins' score between 6 and 11 (Wilkins' score at 8 in 1/3 of patients and 9 in ½ of the cases). Mean transvalvular gradient was high (21.4mmHg) and most of our patients had pulmonary hypertension (mean Pulmonary Artery systolic pressure 71mmHg: 78% had PASP > 50mmHg and 19% had major pulmonary hypertension (PASP > 100mmHg).

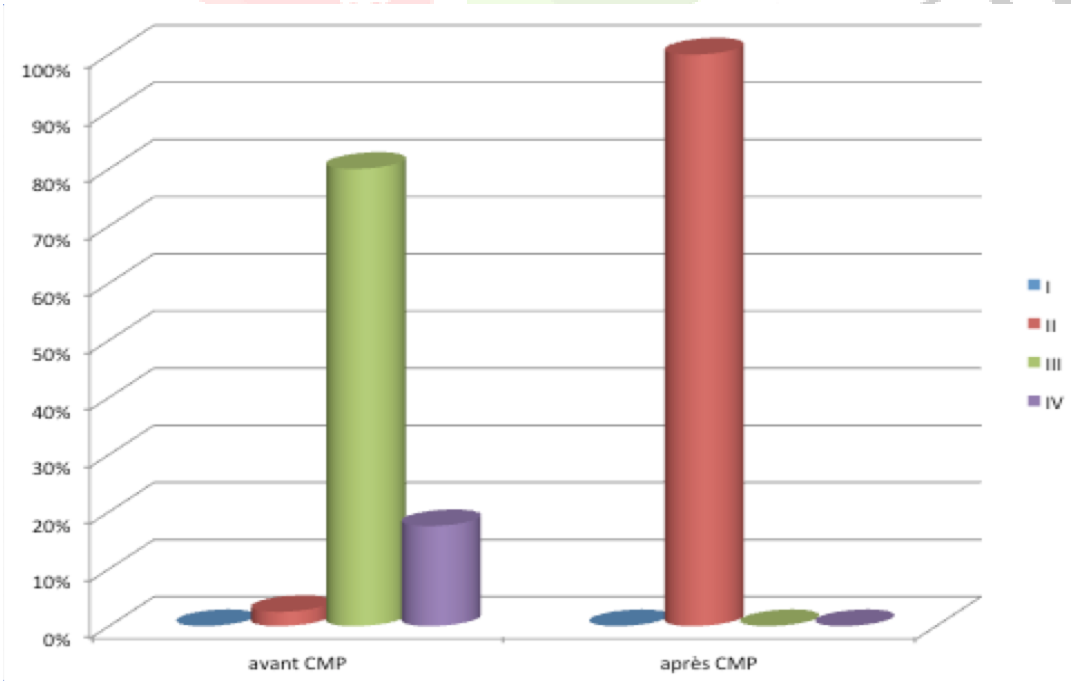
PMC was performed towards the end of second trimester; we preferred to wait till the 20th to 24th week of amenorrhea. Nevertheless 6 of pour patients who presented with refractory acute pulmonary edema underwent PMC irrespective of gestational age for the mothers' sake.

The procedure never lasted longer than one hour (between 35 and 75 minutes) with a scopy time of 6 to 10 minutes. The procedure had 98% success rate with immediate regression of symptoms to NYHA stages I to II in 95% cases.

During and after the procedure, the same echographic parameters were evaluated for all the patients.

The echocardiographic and hemodynamic results before and after PMC are summarized in the following table:

	Before PMC	After PMC	
MS (cm²)	0,8 [0,7 – 1]	2 [1,8 – 2,3]	< 0,001
Mean Gr (mmHg)	21 [17 – 25]	7 [4 – 8]	< 0,001
PASP (mmHg)	71 [58 – 91]	40 [30 – 46]	< 0,001



NYHA Classes before and after PMC

The medical treatment our patients were on is detailed in the following table:

	Avant la DMP	Après la DMP
Beta blockers	85 %	95 %
Diuretics	100 %	55 %
Digitalis	27 %	24 %
Anticoagulants	43 %	20 %

Table 2: Medical therapy before and after PMC

The per and post procedural complication rate was 1.8% : we regret the onset of massive surgical mitral regurgitation in one of our patients who gave birth through cesarean section and had to undergo valve replacement post-partum. A patient presented with tamponade during catheterization and was drained percutaneously after which dilation was successfully carried out. Two patients died of serious stroke. No miscarriage occurred after the procedure.

Labor spontaneously began at 38 ± 1 week of amenorrhea; 85% of our patient had vaginal birth whilst 15% went through cesarean section for obstetrical reasons. At full term, all patients were hemodynamically stable.

After PMC, pregnancy reached full term in 95% of the cases with a low fetal morbimortality (88% of the newborns were eutrophic with birthweight of 2800 ± 250g, 6% were hypotrophic and 6% premature).

The long-term follow-up of dilated patients stretched between a period of 5 to 17 years. Within the period of 44 ± 39 months, event rate (death, surgery or redilation) was 10%.

In our series the results of PMC during pregnancy were maintained at long term and were superposable to those of non-pregnant dilated patients. Thus we found the same predictors of resténose which are: unfavorable valvular anatomy (elevated Wilkins' score, average immediate result (modest surface area post dilation with absence of commissural opening, Mitral regurgitation > grade II.

Long term follow-up of children born after PMC during pregnancy stretched up to 4 years and showed growth and intellectual development comparable to children of the same age, with a consequent 17-year retrospect showing equivalent results and absence of radiology-induced pathologies thus confirming the innocuousness of PMC during pregnancy.

DISCUSSION

Rheumatic heart disease is still epidemic in developing countries especially in Morocco; it accounts for half of the cardiac complications during pregnancy and mitral stenosis is the chief culprit (75% of cases).

Mitral stenosis is also the most frequently diagnosed valve disease during pregnancy, it is poorly tolerated and associated with many materno-fetal complications. Between the 20th and 24th week of amenorrhea, heart output increases by 40 to 50% in order to satisfy fetoplacental circulation. Blood volume increases and arterial resistances fall. Heart rate increases by 10 to 20 beats per minute. Mitral stenosis coupled with these hemodynamic modifications increases the pressure in the left atrium and in the pulmonary capillaries, which could lead to an acute pulmonary edema and fetoplacental hypoxia, the frequent causes of fetal distress and miscarriages. Il is a hemodynamic emergency. In these cases maternal mortality increases from less than 1% for stages I to II to 7%. For stages III to IV, it reaches 17% if atrial fibrillation is associated. 30% fetal mortality for NYHA stage IV [4,5]. Labour and delivery is the most critical period.

Ideally, mitral stenosis diagnosed before pregnancy should be managed before conception but this is not always the case

In symptomatic cases during pregnancy, it is necessary to increase mitral valve surface area [8]. PMC is the ideal treatment because of it's low fetal and maternal risk, and imposes itself as the ideal treatment for mitral stenosis during pregnancy. It's per-pregnancy benefits are certain: it yields spectacular hemodynamic and clinical amelioration and allows pregnancy reach full term [9]. The risks involved are clearly lower thatn with other surgical

alternatives. The advent of PMC coupled with progress in cardiac catheterization has led to the abandon of closed heart mitral commisurotomy.

Mitral dilation during pregnancy when indicated should be performed after the second trimester of pregnancy (at the end of organogenesis) [3]. In different series [4,5], it is performed after the 12th to 14th week of amenorrhea but we preferred waiting till the 20th to 24th week in our experience in the absence of hemodynamic instability.

The risk of fetal irradiation during the procedure was the major obstacle to PMC during pregnancy. During a PMC procedure, 0.2 rads is received on the average and this is largely inferior to the 5 rads maximal tolerated dose during pregnancy. Prohibiting graphy and limiting scopy time using it only during trans septal puncture and balloon inflation is recommended during pregnancy.

Some teams use trans thoracic and especially trans esophageal echocardiography to guide trans septal path and reduce irradiation [2]. Transoesophageal echocardiographyis performed under general anesthesia (which is not always possible) and prolongs the procedure.

Protection of gravid uterus by means of a lead apron was systematic for all our patients and in many other series reported in literature [3,4,5]. Nevertheless it has not proven it's efficacy so remains controversial: it could prevent internal radiation dispersion [2]. Some authors hint that the lead apron could have adverse effects, saying that it could increase the dose of radiation that reaches the fetus! [6].

Many studies have proven the efficacy and security of PMC procedure during pregnancy [5, 7, 8]. The incidence of complications in recent series is less than 1% and continues to fall with increase in expertise [8, 4] (stroke being the most feared complication). It is worth noting that maternal mortality during PMC is almost zero.

Immediate results of PMC during pregnancy are excellent with an efficacy of nearly 100% in majority of the series.

	Nombre de patientes	Taux de succès (%)	Mortalité maternelle (%)	Mortalité fœtale (%)
Meta analyse 1992	21	100	0	4,8
Chow et al. 1992	2	100	0	0
Gangbar et al. 1992	7	100	0	0
Ribeiro et al. 1993	7	100	0	0
Patel et al. 1993	20	100	0	0
Ben Farhat et al 1997	44	100	0	0
Martinez-Reding et al. 1998	9	100	0	0
Arora et al. 1999	215	100	0	0,9
Esteves et al 2006	71	100	0	1,4
El Haitem et al 2018	246	98	0,9	0,9

Table 5 : efficacy and security of PMC in different literature series

PMC results in a clear regression of symptoms (95% of our patients were at NYHA stages I – II after dilation) and considerably improves hemodynamic parameters (fall in pulmonary and left atrial pressures, increase in mitral surface area and cardiac output). It also enables a reduction in the number and dose of drugs. On the other hand improvement of hemodynamic parameters after PMC reduces the risk if intrauterine growth retardation and prematurity. Lastly, PMC improves delivery and post partum conditions.

Long-term follow-up of patients dilated during pregnancy spans over a period of 5 to 17 years in reported series [3,4,8]. Over a period of 44 ± 39 months, events rate (death, surgery or redilation) was 14.3% in Estève's series[5]. This series also showed that the outcome of patients dilated during pregnancy was comparable to that of a population dilated mitral stenosis in Massachusetts.

Similarly in our series the results of PMC during pregnancy were maintained at long term and were superposable to those of non-pregnant dilated patients. Thus we found the same predictors of resténose which are: unfavorable valvular anatomy (elevated Wilkins' score, average immediate result (modest surface area post dilation with absence of commissural opening, Mitral regurgitation > grade II.

Long term follow-up of children born after PMC during pregnancy spanned between 3 and 7 years in different studies [4,5, 9] and showed growth and intellectual development comparable to children of the same age. Gulraze with a 17-year retrospect showed equivalent results and absence of radiology-induced pathologies thus confirming the innocuousness of PMC during pregnancy [3].

Broadening PMC indications during pregnancy.

PMC during pregnancy is undoubtedly the ideal treatment for symptomatic mitral stenosis (stages III – IV despite optimal medical therapy) in the absence of absolute contra-indications: Moderate to important mitral regurgitation and massive left atrial thrombus [10].

The efficacy and security of PMC during pregnancy has been clearly demonstrated. Furthermore the expertise and experience of many teams has led to the extension of the indications of PMC during pregnancy. It should be discussed for patients with very severe mitral stenosis (valve area < 1cm²) irrespective of functional status due to high risk of materno-fetal complications in this group of patients [11]. It could also be considered for patients requiring long hospitalizations of high doses of medical therapy [5]. Finally PMC indication can be dictated by patients' socio-economic status:high risk of inadequate medication compliance or uncertain pregnancy and delivery follow-up [11]. PMC can even be performed on patients with heart failure and unfavorable vale anatomy (calcified valves) to assure pregnancy and delivery in good conditions, this serving as a bridge to post partum surgery.

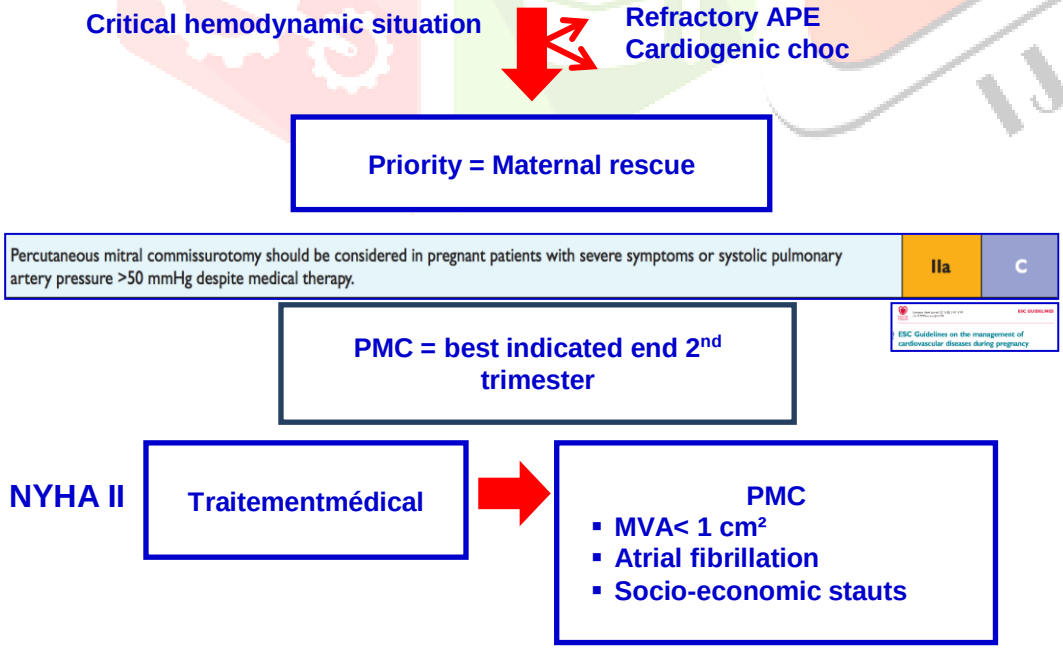


Figure 6: PMC indications during pregnancy

CONCLUSION

PMC has low materno-fetal risk and is the ideal treatment for mitral stenosis that remains symptomatic despite optimal medical treatment. As a matter of fact, this technique does not require general anesthesia and is less stressful for mother and fetus compared to closed heard mitral commisurotomy [4, 5]. It reduces fetal risk if performed by an experienced team after the 20th week of gestation. PMC is an alternative to medical therapy for moderate mitral stenosis in pregnant women in order to prevent per-partum maternal death. The results of our studies clearly shows that trans-septal PMC for mitral stenosis during pregnancy is a seductive and effective procedure.

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