LAPAROSCOPIC MYOMECTOMY VERSUS OPEN MYOMECTOMY- A CRITICAL REVIEW OF THE LITERATURE

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Abstract
Uterine fibroid is the commonest benign tumour of the female genital tract.
The cause of fibroid is unknown but its growth is believed to be dependent on ovarian steroid and epidermal growth factors.
Symptoms of fibroid include menorrhagia, abdominal mass with or without pressure symptoms. It has an unclear relationship with infertility. Significant proportion of cases of fibroid is asymptomatic.
Management of symptomatic fibroid has traditionally been either hysterectomy in women who have no desire for more children or myomectomy for those who desire to have more children or wish to keep their uterus. Newer uterine conserving treatments are available too.
Myomectomy has hitherto been by laparotomy but with the advent and perfection of minimal access surgery increasing number of myomectomies are been done by Laparoscopic approach in hospitals with the equipment and expertise. Several papers have been published highlighting the superiority of laparoscopic myomectomy over open (laparotomic) myomectomy.
The aim of this review is to critically compare outcome of laparoscopic myomectomy versus open myomectomy by reviewing relevant studies published in the literature between 2000 and 2008.

INTRODUCTION
Uterine fibroids are the commonest benign tumor of the female genital tract with a prevalence of about 20% among women in the reproductive age group.[1]
The incidence is increased in women of Afro-Caribbean origin. [2]
Uterine fibroids are benign growth of the uterine smooth muscle interlaced with varying proportion of fibroblast. They may be single or multiple and are of varying sizes ranging from 1cm to over 30cm in diameter and may be sub serous, intramural or sub mucous in location. [3]
The trigger of the initial development of fibroid remains unclear, however clonality studies using homozygosity of glucose 6-phosphate dehydrogenase forms show that multiple tumors in the same uterus are derived from individual myometrial cells and not through a metastatic process. Cytogenetic studies suggest some form of chromosomal translocation, deletion, structural aberration or even gene mutation as the initial trigger of fibroid development. [4]
The growth of fibroid is dependent on ovarian steroid hormone and growth factors such as growth factor B, granulocyte-macrophage colony stimulating growth factor and epidermal growth factors are also implicated in the growth of fibroid. [5]

Typically fibroid present clinically with menorrhagia in the majority of those with symptoms in association with or without a palpable uterine mass. The menorrhagia is partly due to sub mucous location of the fibroid, the associated abnormal endometrial function and the enlarged uterine size [6, 7] It's instructive to note that a significant proportion of fibroid are without

symptoms and the relationship of fibroid with infertility is unclear. [8]
Ultrasound examination is useful in determining the number, size and location of the uterine fibroid and these have implications in the management approach. Evaluation of tubal patency is also an essential part of the work up towards treatment as some cases are associated with complaints of infertility**.**[9]
.Management of symptomatic fibroid includes medical therapy with hormonal manipulations [10, 11, 12] or surgical removal of the fibroid or a combination of both. Uterine artery embolisation with consequent reduced blood supply to the uterus and fibroid shrinkage is a recent treatment modality with its pros and cons. [13, 14, 15]

Traditionally, surgical management entails either doing a total hysterectomy or myomectomy in women who still wish to have more children or desire to keep their uterus as often seen in developing countries. [9]
Myomectomy until recently was by open surgery i.e. laparotomy, but with the advent and perfection of laparoscopic surgical technique [16] increasing number of myomectomies are now done via operative laparoscopy. Basically laparoscopic myomectomy means removal of uterine fibroid through 'pin' holes (3or 4) in the anterior abdominal wall with the aid of a telescope with a fitted camera and a monitor that displays the picture of the procedure on a screen to guide the surgeon during the operation. Characteristically laparoscopic surgeries tend to be slow because of difficulties in manipulations caused by loss of dept perception and sense of touch that are associated with laparoscopic procedures.**[17]** In the recent time Laparoscopic surgeries have been modified to include vaginal assisted laparoscopy and laparoscopic myomectomy plus minilaparotomy for tissue retrieval. These modifications were introduced to reduce difficulties envisaged if the fibroids are large and also reduce the operating time. Proponents of laparoscopic surgery have reported profusely on the advantageous outcome of laparoscopic myomectomy over open myomectomy.
The aim of this study is to review the available literature on myomectomy and comparatively and critically analyze the selection criteria and outcome of laparoscopic and open myomectomy.

Materials and Methods
A literature search was performed using the Medline and Cochrane library and the Google search engine using the following search leads:
Laparoscopy, Laparotomy, Myomectomy, Outcome, Pregnancy, hospital stay, Complications, reproductive performance.
Criteria for selection of articles were: Title; this must be relevant to the review, methodology; this must be comparative analyses of laparoscopic surgery versus open myomectomy and preferably randomized trials with standard statistical analysis.
Results
Nine articles were selected for review. Six of the articles were prospective randomized trials (one of the 6 was double blind). One was a retrospective matched control analysis and two articles were comparative analyses that were not controlled for any variable. They were analyzed for indication for myomectomy, selection of patients for laparoscopic approach or laparotomy, complication and quality of life and reproductive performance after the operation.

Results.
Table 1- Summary of reviewed articles

Author and year/outcome	**Methodology**	**Laparoscopy**	**Laparotomy**	**P value**

Holzer et al **[18]** **2006** Pain	Double blind	 +	 +++	 0.05
Holub et al **[19]** 2006 Selection: size of fibroid mean Serum level of acute phase response indicators	Not randomized	 <6cm 4.8cm 1st day value + 3rd day value +	 >6cm 6.9cm 1st day value + 3rd day value +++	 <0.05
Stringer et al **[20]**.1997 Indication Uterine size Op time(min) Bld loss(mean) Total days in hosp Max days/pt Mean days Post op adhesion Bld txn Cost Pregnancy	Not randomized	N=49 Same 9-11wks (51%) 264 340ml 29 3 0.6 + 5/49 Nil 13.814 +	N=49 Same 12-14wk (43%) 133 110ml 272 25 5.6 ++ 17/49 3 patients 14.461 -	 0.0001 0.001 0.0001 0.0001 0.001 0.0068 0.65 Not sig
Alessandri et al 2006 **[21]** Op time Hb drop Hosp stay Recovery time Complication Cost(euro)	Randomized	 +++ + + + ++ 2250	Mini lap + +++ ++ ++ Nil 1975	 0.001 0.001 sig 0.012
Palomba et al	Randomized controlled			

[22].2007 Op time Op difficulty Blood loss Post o pain		 +++ +++ + +	 ++ + ++ +++	
Palomba et al**[23]** 2007 Cumulative Preg abortion Live birth Preg/cycle Live birth/cycle Time to 1st preg	Randomized controlled	 Same Same Same ++ ++ +	 Same Same Same + + +++	Unchanged in pt with unexplained infertility
Advincula et al**[24]** 2007 Age (mean) BMI Myoma wt(av) Blood loss Hosp stay Op time Complications Cost	Retrospective case matched analysis	Robotic assisted laps Same Same Same + + + + +++	 Same Same Same +++ +++ +++ +++ +	
Mais et al **[25]** Pain Hosp stay	Randomized but not controlled	 + +	 +++ +++	
Marret et al **[26]** 2004 Myoma size/no Blood txn	Retrospective comparative analysis	 + - +	 +++ Nine patients	

Hosp stay Laparoconversion Recurrence - 2yrs		29% 2.5%	+++ 3.6%	
Rosseti et al **[27]** 2001 .Recurrence	Randomized Follow up for up to 40months	 27%	 23%	
Author and year/outcome	**Methodology**	**Laparoscopy**	**Laparotomy**	**P value**
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Alessandri et al 2006 **[21]** Op time	Randomized		Mini lap	

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Mais et al **[25]**	Randomized but			

Pain Hosp stay	not controlled	+ +	+++ +++	
Marret et al **[26]** 2004 Myoma size/no Blood txn Hosp stay Laparoconversion Recurrence - 2yrs	Retrospective comparative analysis	+ - + 29% 2.5%	+++ Nine patients +++ 3.6%	
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Palomba et al **[22]**.2007 Op time Op difficulty Blood loss Post o pain	Randomized controlled	 +++ +++ + +	 ++ + ++ +++	
Palomba et al**[23]** 2007 Cumulative Preg abortion Live birth Preg/cycle Live birth/cycle Time to 1st preg	Randomized controlled	 Same Same Same ++ ++ +	 Same Same Same + + +++	 Unchanged in pt with unexplained infertility
Advincula et al**[24]** 2007	Retrospective case matched analysis	Robotic assisted laps	 Same	

Age (mean) BMI Myoma wt(av) Blood loss Hosp stay Op time Complications Cost		Same Same Same + + + + +++	Same Same +++ +++ +++ +++ +	
Mais et al **[25]** Pain Hosp stay	Randomized but not controlled	 + +	 +++ +++	
Marret et al **[26]** 2004 Myoma size/no Blood txn Hosp stay Laparoconversion Recurrence - 2yrs	Retrospective comparative analysis	 + - + 29% 2.5%	 +++ Nine patients +++ 3.6%	
Rosseti et al **[27]** 2001 .Recurrence	Randomized Follow up for up to 40months	 27%	 23%	

Holzer et al [**18]** in a double blind setting evaluated the post operated pain following laparoscopic myomectomy(n=19) versus open myomectomy(n=21) and found the overall visual analog scale score at 24, 48 and 72 hours post op was significantly lower in the laparoscopy group(2.28 +/- 1.38 versus 4.03 +/- 1.63; $P < 0.01$)

In 2006, Holub et al[**19]** evaluated inflammatory response following laparoscopic myomectomy versus open myomectomy in a comparative but not randomized setting. They found higher level of serum indicators of inflammatory response (C –reactive protein, Interluekin-6, amyloid A, WBC, and creatinine kinase) among women who had open myomectomy. The women who had open myomectomy had larger fibroid masses.

.The work by Springer et al [**20]** was a retrospective review of patients who had open myomectomy between 1983 and 1995(n=49) and those who had laparoscopic myomectomy between 1993 and 1995(n=49). The setting was the private practice of one surgeon and department of Obstetrics and Gynaecology of a Medical college in Chicago, Illinois. They found out that the mean operative time was longer among the laparoscopic group (P=0.001) but the blood loss was more with open myomectomy (P=0.001.) They also documented a longer hospital

stay, more post operative complications and adhesion amongst the patients who had open myomectomy. Reproductive performance was also better among the laparoscopic group. The costs of both procedures were not significantly different.

The study by Alessandri et al [**21]** was a randomized comparative study of women who underwent laparoscopic myomectomy versus minilaparotomy myomectomy in a University hospital setting in Italy. They reported a significantly lower decline in haemoglobin level, shorter duration of hospital stay and lower need for analgesic in the laparoscopy group than the minilaparotomy group. Post operative recovery was also noted to be significantly earlier in the laparoscopy group than in the minilaparotomy group. They however reported more complications (one laparoconversion and one case of diffuse peritonitis from ileal perforation) in the laparoscopy group. There were no complications in the minilaparotomy.

Palomba et al **[22]** did a multicenter randomized controlled study to assess the short term outcomes of laparoscopic versus minilaparotomy. In their work, they reported longer operation time with laparoscopy but blood loss and post operative pain was more after minilaparotomy. Hospital stay was also longer with minilaparotomy.

In another study, **[23]** Palomba et al evaluated reproductive performance after laparoscopic and open myomectomy. Pregnancy rates and live birth per cycle was better after laparoscopic than after open myomectomy in patients with symptomatic fibroids but there was no difference in patients who had unexplained infertility.

Advincula et al **[24]** carried out retrospective analyses of the outcome of robot assisted laparoscopic myomectomy against open myomectomy in patients that were similar in terms of age, body mass index and myoma weight. They reported reduced blood loss and shorter hospital and fewer complications with robot assisted laparoscopic myomectomy compared to open myomectomy but the operative time was longer and cost was also higher with robotic assisted myomectomy.
In a prospective randomized trial published in 1996, Mais et al **[25]** reported less post operative pain and shorter hospital stay after laparoscopic myomectomy than after open myomectomy.
Marret et al [**26]** conducted a retrospective multicenter study to determine the characteristics of myoma before surgery and to outcomes in current practice.
They reported that patient who had myomectomy had more and larger fibroids and incurred more blood loss and longer hospital than patients who had laparoscopic myomectomy. Nine patients in the myomectomy group were transfused but none who had laparoscopic myomectomy received blood transfusion.

In the study by Rossetti et al,**[27]**the recurrence of fibroid after 40 months of follow up of patients randomized to laparoscopic and open myomectomy was similar in both groups

Discussion
Myomectomy is often performed for a woman with symptomatic fibroid but still desires to have more children or still want to keep her uterus. The feared complications of myomectomy are usually excessive blood loss at operation, injury to surrounding organs during surgery, post operative pain, post operative infection and residual abdominopelvic adhesion. The latter may have serious consequences on the patient's future reproductive potentials.
The selection criteria for either laparoscopic or open myomectomy was similar in all the articles reviewed. The operations were performed for women with symptomatic fibroid with or without associated infertility. The patients were randomized to treatment arms in six of the studies **[18,**

21, 22, 23, 25, 27] while in two of the retrospective studies [19, 25], patients who had big fibroids were selected for open myomectomy.

Of all the papers reviewed in this study only four **[20, 21, 22, 24]** reported on the operation time. While Stringer et al,**[20**] Alessandri et al,**[21]** and Palomba et al **[22**] reported longer operation time with laparoscopy, Advincula et al reported that Laparoscopic myomectomy was accomplished faster than open myomectomy. It is instructive to note that in the work of Stringer et al **[20]**, the women who had open myomectomy had bigger and more fibroids than the laparoscopy group while in the study by Advincula et al[**24]** the myoma size and number were similar in both groups. The speed of surgery depends on the task that is performed during the procedure and the processes of executing these tasks. In laparoscopic surgery the operator performs without the touch effect and under defective dept perception circumstance. The speed at which laparoscopic procedures are accomplished to a very large extent depends on the experience of the surgeon in addition to the number and sizes of fibroid present. And because laparoscopic surgery is relatively new, different surgeons are bound to report different operating time reflecting their individual learning curve at various times.

Blood loss at surgery is a concern at fibroid operations irrespective of the approach. In this review, four studies evaluated blood loss**[20,22,24,26]**, three [**22,24,26**] of the four studies concluded that open laparotomy was associated with more blood loss and in two of the studies**[20,26]** blood transfusion rate for open myomectomy was 5.1% - 34.7% in the laparotomy group and in the laparoscopy group it was 10.2%.**[20]** A closer look at the study that recorded 34.7% transfusion rate among the laparotomy group showed that they had more and larger fibroid masses than the laparoscopy group. Blood loss is therefore primarily related to the number and size of the fibroids removed and secondarily to the experience of the surgeon and haemostatic measures applied during surgery. The reduced blood loss at laparoscopy may be due to the effectiveness of electrocuagulation and the other coagulating instrument used in laparoscopic surgery such as the harmonic machines and ligasure. And also laparoscopic surgery being a new technique, under reporting bias can not be completely ruled out.

The issue of pain after myomectomy is a concern to all practicing gynaecologist as it is a major factor that impacts on patient satisfaction after any operation. Only three **[18, 22, 25]** of the studies reviewed specifically dwelt on the issue of pain following myomectomy and they all reported more pain following open myomectomy than laparoscopic myomectomy. One other study by Holub et al **[19]** reported a higher level of serum markers of acute inflammatory response on post-operative day 3 among the laparotomy group.

The reduced pain following laparoscopic surgery is attributable to the minimal dissection and disturbance of the normal anatomy associated with laparoscopic surgery unlike the situation in open surgery where dissection can be quite extensive.

One way of assessing difficulty encountered at Laparoscopic myomectomy is the incidence of laparoconversion i.e. abandoning minimal access surgery midway into the procedure and going ahead to complete the operation by the open approach. Only one of the studies reviewed reported on this issue. Marret et al **[26]** reported a laparoconversion rate of 29%. This is a reflection of either poor selection of cases for laparoscopy or inexperience on the part of the surgeon.

Common complications following myomectomy include injury to surrounding organs, infection, thomboembolism and post operative adhesions. Four of studies reviewed **[20, 21, 24, 26]** reported more complications among the Laparotomy group than in the laparoscopy group. There were no statistically significant difference in recurrence rate according to the studies by Marret et al **[26]** and Rossetti et al **[27]**

The duration of hospital stay is an index of post operative morbidity and this impact on the cost of health. Five of the papers**[20,21,24,25,26]** reviewed reported significantly longer duration of hospital stay amongst women who had open myomectomy but on the issue of cost, two [20,23]of

the three studies that evaluated cost in this review reported that laparoscopy was significantly more expensive while the third study**[20]** showed no difference in cost. The fact that laparoscopic myomectomy patients are discharged within 48-72 hours after surgery **[20, 21, 24, 25, 26]** really shows how expensive this treatment modality can be. This has an implication for resource constrained communities particularly in settings where health care financing is borne by the patients without subsidy or health insurance scheme.

The pregnancy and delivery rates per cycle following surgery was better after laparoscopic myomectomy **[23]**

CONCLUSION

This review has shown that Laparoscopic myomectomy has some obvious advantages over laparotomic myomectomy. Apart from the longer duration of operation time associated with laparoscopic myomectomy there are reported evidences of less post operative pain, shorter duration of hospital stay and fewer complications with laparoscopic myomectomy than open myomectomy. The reported blood loss and increased blood transfusion rate amongst patient with open laparotomy may reflect the type of patient that is logically referred for open myomectomy. In the course of preoperative evaluation, patients with huge and multiple fibroids are expectedly assigned to open myomectomy because operating on such patient would require more space for manipulation to remove the fibroids without damaging vital surrounding organs like the bladder, ureter and bowels. The location of the fibroid also influences choice of surgical approach. Most broad ligament fibroid are safer removed by open surgery and haemorrhage is a major concern here. Generally, where there is anticipated operative difficulty because of the number, size and location of the fibroid masses, such patients are usually offered open myomectomy. Taking the foregoing into consideration, the question of comparing outcome between laparoscopic myomectomy and open myomectomy becomes itself questionable because the two groups of patients (i.e. laparoscopic versus open myomectomy groups) can hardly be homogenous in terms of number, size and location of the fibroids. Open myomectomy under this scenario would often involve more tissue manipulation and therefore more blood loss and also expectedly more post operative pain. It's often argued that a well trained laparoscopic surgeon can operate any fibroid. The removal of large fibroids and repair of myometrial defects are challenges to gynaecologic laparoscopists and also the main limitations. In the experience of Holub, as well as reflected in the literature, a consensus is gradually emerging that laparoscopic myomectomy is safe for fibroids not more than four in number with maximal size of 8-10cm.**[28]**

In developing countries where, patients often present late to the hospital with very large fibroid masses**[9]** because of ignorance, and cultural and financial influences on health seeking behavior of the people, open myomectomy would continue to have patronage particularly as laparoscopic procedures are still very expensive and the expertise is still resident in developed and few developing countries. However, there is an urgent need to extend the laparoscopic technology and expertise to developing countries through organized training and at affordable cost so that women who qualify for laparoscopic myomectomy can benefit from this fantastic treatment modality which is already a routine in developed countries.

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