

# Difference in outcomes of category 1 caesarean section patients in relation to type of anaesthesia administered: a tertiary university hospital experience

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## Summary

**Background:** Category-1 caesarean section denotes cases of immediate risk and a life threat to either mother or fetus and delivery is imminent. General anaesthesia (GA) is often the method of choice but it carries significant life threatening risks to the mother. Regional anaesthesia (RA) i.e. single shot spinal anaesthesia, should be considered; as in competent hands it can be performed as quickly and is much safer than GA. **Objective:** To compare the maternal and fetal outcomes between GA and RA and to prove that at least 50% of category-1 cases do not require general anaesthesia. **Materials and Methods:** Data collection of all category-1 caesarean sections were divided and analysed via the anaesthetic regime used (GA or RA). **Results:** The caesarean section was 47.4%. GA rate of category-1 was 24.3%. No significant difference of fetal outcome between GA and RA. The difference of maternal pre and post-operative haemoglobin is significantly larger in the GA group. **Conclusion:** RA is a safer method of anaesthesia in more than half the cases of category-1. GA is still a primary method of choice in some cases. Proper and effective communication between obstetricians, anaesthetists, and midwives is vital to ensure the safest treatment is given to patients.

**Key words:** Category-1 caesarean section; Regional and general anaesthesia; Maternal and fetal outcomes.

## Introduction

The rate of caesarean section deliveries is rapidly increasing every year especially in urban areas. This phenomenon is largely influenced by the improvements in peripartum fetal monitoring and early intervention of pregnant mothers which lowered the threshold for operative intervention [1, 2]. The National Health Service Maternity Statistics reported a rising trend of caesarean section rates in England from 12% in 1990 to 26.2% in 2013/14 [3]. This is also reflected in the United States where the caesarean section rate had reached its peak of 32.9% in 2009 but showed a decline to 32.7% in 2013 [4]. Although the rates are declining, it is still relatively high and warrants due attention. In Malaysia, a total of 504,104 deliveries were reported in the year 2010. The overall vaginal delivery rate was 72.6% and instrumental delivery rate was 5.4%. The total lower segment caesarean section rate increased from 20.8% in 2008-09 to 21.9% in 2010 [5].

The indications for a caesarean section vary from compromised fetal or maternal state to less urgent situations such as cephalopelvic disproportion or failure of labour to progress and to elective cases such as stable placenta pre-

via, fetal macrosomia, and even maternal request. Both the health of the mother and the unborn baby are important considerations when providing anesthesia for emergency caesarean sections. In an emergency setting, a multidisciplinary team approach is vital to ensure the best maternal and fetal outcome and a safe and pleasant experience for the parturient.

For better prioritization of cases and communication between obstetrician and anesthetist, Lucas *et al.* developed a four-point classification system to describe the urgency of caesarean section [6]. This categorization was recommended for use in the UK by the National Institute for Clinical Excellence (NICE). A category-1 caesarean section refers to the subset of cases where there is an immediate risk and life threatening circumstances for either the mother or fetus, and delivery must be undertaken as quickly as possible after the decision [7]. This classification has proved to be reliable despite some inconsistencies in clinical application amongst different obstetric units [8]. The classification system is as shown below in Table 1 [6].

Causes of category-1 caesarean section have never been explored thoroughly. Generally, the possible causes are placenta previa with major haemorrhage, fetal bradycardia,

placental abruption, maternal cardiac arrest, cord prolapse, and an attempt for vaginal birth after caesarean (VBAC) with signs of uterine rupture and fetal blood sample with pH less than 7.

In 2009, Kinsella and Scrutton modified the wording of the urgency classification but failed to show any significant differences [9]. Alternative classifications have been suggested including that by Dupuis *et al.* who proposed a novel three-colour code to categorise urgency [10]. The adoption of the colour code was shown to have a significant shorter mean decision-to-delivery interval (DDI). Other classification, such by Leung *et al.* is based on the causes of fetal bradycardia, whether it is irreversible, potentially reversible or unknown (no identifiable cause). This study showed cord arterial pH deteriorates with bradycardia-to-delivery interval when the underlying cause of fetal distress is irreversible, but not so otherwise [11].

A UK survey found that 10% of caesarean sections performed were classified as category-1 cases and these were associated with a higher morbidity and mortality [12]. There is a 15-fold increased risk of maternal death in category-1 patients compared with category-3 [13]. However, it remains controversial whether this increased risk is due to a pre-existing condition or as a direct consequence of the need for the category-1 caesarean section. Managing category-1 caesarean section delivery is challenging to both anaesthetist and obstetrician.

The anesthetic technique depends on various factors including the urgency and indication of the operation, coexisting medical problems, as well as maternal preference. Therefore, proper communication between anesthetists, midwives, and obstetricians is crucial in choosing the most suitable technique [12]. A poorly coordinated team could lead to unnecessarily high general anesthesia (GA) rates which is known to have a 17-fold higher risk of maternal death as compared to regional anesthesia (RA) [14]. The rate (51%) of GA in category-1 caesarean section is significantly higher than other categories and it continues to be an important, direct cause of maternal mortality and morbidity [12]. Since 1979, results from Centre for Maternal and Child Enquiries (CMACE, formerly CEMACH) reports for direct maternal deaths show a greater risk from GA than from RA [15].

To ensure maternal and fetal well-being with expedited delivery, there has been much discussion on the optimal DDI and its clinical relevance to maternal and fetal outcomes. A DDI of 30 minutes for category-1 caesarean section has been recommended as a standard by the guidelines published by the Royal College of Obstetricians and Gynaecologists, the American College of Obstetricians and Gynecologists, and the Canadian National Consensus Conference [16]. However, most studies found no correlation between DDI and maternal morbidity [17, 18] and also no improvement in neonatal outcomes [14, 18-20].

The balance between ensuring a safe delivery and an ex-

Table 1. — Four-point classification system to describe the urgency of caesarean section.

Grade 1 (emergency)	Immediate threat to life of woman or fetus
Grade 2 (urgent)	Maternal or fetal compromise, not immediately life threatening
Grade 3 (scheduled)	Needing early delivery but no maternal or fetal compromise
Grade 4 (elective)	At a time to suit the woman and maternity team

pedited one can be difficult and requires good teamwork and communication by members of healthcare disciplines to ensure the safety and health of both the mother and fetus. Hence specific local hospital protocols and training for members of the team may be essential to improve the outcomes of the category-1.

## Materials and Methods

This is a prospective observational cross-sectional study of all cases of category-1 caesarean section (immediate threat to life of woman or fetus) in University Malaya Medical Centre (UMMC) from January to August 2015. The study was approved by the University Malaya ethics committee (MECID NO 20155-1375).

A total of 70 patients who underwent caesarean section (classified as category-1) were enrolled. Enrolment to study calculations were based on prevalence of category-1 caesarean section of 10% in UK [12]. This gives the study a power of 90% with an error of 5%. Furthermore, a 10% drop out rate was added. The authors divided samples into two groups: caesarean section performed under GA and caesarean section performed under RA. Of the study groups, they collected data on fetal outcomes (cord blood pH and base excess, APGAR scores at one and five minutes), mode of anesthesia, time intervals (decision for caesarean section to time of delivery, and time from induction of anesthesia to skin incision), estimated blood loss, pre and post-operative hemoglobin, as well as demographical data.

Statistical comparisons were made using independent-samples T-test or chi-squared test and Fisher's exact test. A probability of < 0.05 was taken to be statistically significant.

According to the four-point classification of urgency of caesarean section by Lucas *et al.*, category-1 caesarean section must be done as soon as possible and is likely to be performed under GA to ensure the safety of fetus or mother [6]. GA is considered high risk in obstetric patient due the physiological changes which lead to an increase risk of aspiration, difficult airway manipulation, and low oxygen reserve [21, 22]. The objective of this observational cross-sectional study is to prove that at least half of the cases in category-1 do not require GA. This is supported by showing no difference in fetal and maternal outcome in relation to the mode of anesthesia. The other objective is to review the indication of GA in category-1 caesarean section.

## Results

A total of 2,226 deliveries were recorded from January to August 2015, with a caesarean section rate of 47.4%. As seen in Table 2, 6.6% of total caesarean section were clas-

Table 2. — Characteristics of the category-1 caesarean section study population (n= 70)\*.

		(95% confidence interval)
Age (years)	30.96 ± 4.37	(29.92-32)
<i>Indication of category-1 CS</i>		
Fetal bradycardia	59 (84.3)	
Placental abruption	6 (8.6)	
Cord prolapse	1 (1.4)	
Bleeding placenta praevia	3 (4.3)	
Wound dehiscence	1 (1.4)	
<i>Type of anaesthesia</i>		
GA	17 (24.3)	
RA	53 (75.7)	
<i>APGAR Score</i>		
≥ 7 (one minute)	87.1%	
≥ 7 (five minutes)	95.7%	
< 7 (one minute)	12.9%	
< 7 (five minutes)	4.3%	

Data are presented as n (%) or mean ± standard deviation.

Table 3. — Trial primary outcomes according to types of Anaesthesia of the category 1 caesarean sections.

	General anaesthesia n=17 (24.3%)	Regional anaesthesia n=53 (75.7%)	p value
<i>Indications</i>			
Fetal bradycardia	10 (58.8)	49 (92.5)	
Placental abruption	3 (17.6)	3 (5.7)	
Cord prolapse	1 ( 5.9)	0	
Bleeding placenta praevia	2 (11.8)	1 (1.89)	
Wound dehiscence	1 ( 5.9)	0	
pH	7.17 ± 0.19	7.27 ± 0.06	0.07
Base deficit	5.8 ± 6.7	1.9 ± 2.8	0.03
Apgar Score ≥ 7 (1 min)	21.3%	78.7%	0.21*
Apgar Score < 7 (1 min)	44.4%	55.6%	
Apgar Score ≥ 7 (5 min)	22.4%	77.6%	0.14*
Apgar Score < 7 (5 min)	66.7%	33.3%	
Estimated blood loss	708.82 ± 465.78	498.11 ± 389.15	0.07
Post-op Hb	10.4 ± 2.0	11.1 ± 1.3	0.08
Drop of Hb	1.8 ± 1.4	1.1 ± 1.0	0.03
Decision-delivery time (minutes)	27 ± 16	29 ± 11	0.66
Anaesthesia induction- skin incision interval (minutes)	7 ± 5	8 ± 5	0.52

\*Fisher's Exact Test.

sified as category-1 and 24.3% of the category-1 caesareans were performed under GA. The main indications for category-1 caesareans in general were fetal bradycardia (84.3%) followed by placental abruption (8.6%), bleeding placenta praevia (4.3%), cord prolapse (1.4%), and wound dehiscence (1.4%).

As tabulated in Table 3, of the 17 GA cases, 58.8% (ten) was due to fetal bradycardia, 17.6% (three) placental abruption, 11.8% (two) bleeding placenta praevia, 5.9% (one) cord prolapse, and 5.9% (one) wound dehiscence. On the other hand, 53 cases were done under RA with once again a large proportion (92.5 %) due to fetal bradycardia. Three cases (5.7%) were for placental abruption and one case (1.9%) for bleeding placenta praevia. No attempts were made for a regional technique for cord prolapse and wound dehiscence. Fetal bradycardia was primarily done under a regional technique (83.1%). There was a similar number of cases (three each) performed under a RA or GA technique for placental abruption. Finally, GA was the preferred choice for the other causes of category-1 caesareans.

The mean umbilical cord arterial pH for GA cases was 7.17 while RA was 7.27. This difference was however not statistically significant. On the other hand, there was a significant difference between the mean base deficit between the groups; base of 5.8 compared to 1.9 ( $p = 0.03$ ). Apgar scores of the two groups also showed no clinical significance.

Pre- and post-operative haemoglobin difference was significantly greater in the GA group in comparison with the RA group ( $p = 0.03$ ). Mean DDI and induction of anaesthesia to skin incision interval were lower in GA cases but both were not significant.

## Discussion

Indications for GA for caesarean section include maternal request, contraindications to RA, and emergency situations with potential maternal life threat and or fetal compromise [23]. As it can be administered rapidly, GA is almost always recommended in emergency situations where there is on-going maternal antepartum haemorrhage, cord prolapse or placental abruption with the hope of improving neonatal survival without ischaemic hypoxic injury [24]. However, careful assessment, most importantly of the airway, must be carried out in every patient before choosing this method of anaesthesia.

From the results of this study, it can be seen there is a role of RA for category-1 caesareans. RA was three-fold more likely to be chosen as the mode of anaesthesia for category-1 caesarean. RA should be considered with regards to cases of fetal bradycardia and placental abruption. In the present study, a patient was four-fold more likely to receive RA compared to GA for fetal distress. Furthermore, an equal likelihood of either forms of anaesthesia was considered for placental abruption. This observation can be attributed to presence of good communication and team work between the obstetrician and anesthetist present at the present institution. The safety of considering this is proven by the results, which show no statistically significant difference between fetal pH and Apgar scores between both techniques. Furthermore, there was also no difference for both

techniques in DDI and induction of anesthesia to skin incision time. This however may be due to the fact that the location of the maternity operating theater is located less than 30 meters from the delivery suites and the availability of a dedicated anesthetist for all emergency caesareans. Another aspect that is of significance is in the drop of hemoglobin between the two groups. Previous studies have implicated this by showing a drop in haematocrit between both groups. This can be explained as in RA causes venous pooling which can indirectly decrease blood loss. The significant drop/reduction of hemoglobin may necessitate the need of blood transfusion hence increasing the patient to unnecessary dangers of blood transfusions.

## Conclusion

Category-1 caesarean does not necessarily mean that the preferred choice of anesthesia is a GA. There are certain cases such as fetal bradycardia and placental abruption which can be safely done under a regional technique. A GA technique also does not equate to a faster DDI or mean time from induction of anesthesia to skin incision time. Finally, a GA technique definitely results in a higher surgical blood loss as proven by a larger difference in pre- and post-operative hemoglobin. In addition to the increase risk of aspiration and potential difficulty in intubation, the choice of requesting for a GA technique for category-1 caesarean should be seriously weighted and requires good communication amongst team members despite being pressured by time.

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