

Effects of Caesarean Delivery on Early Infant Health -a Retrospective Study in a Low-Income Community in Ghana

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Abstract

Caesarean birth is gradually becoming the preferred method of delivery among women in many developing countries. With increasing access and improved facilities in low-income countries, the myth and fear surrounding surgery gradually getting eroded with time, it is expected that Caesarean deliveries will increase. Increasing evidence also suggests that Caesarean birth may be associated more with poorer health outcomes in later life.

Objective: This study, sought to determine the effects of Caesarean delivery on early infant health in a low-income in Ghana.

Method: This was a retrospective study where 412 mother/baby pair medical records were reviewed at the Seventh Day Adventist Hospital, Dominase, Ashanti Region. The time-point incidences of dermatitis, respiratory tract diseases, clinical sepsis, neonatal jaundice, conjunctivitis and the mean number of non-scheduled hospital visits were used as indicators of early infant health in the first ninety (90) days. Results: The prevalence of Caesarean birth in the study population was 26.7%. After adjusting for prenatal antibiotics usage and maternal socio-demographic factors, Caesarean birth was found to be strongly associated with the risk of early clinical neonatal sepsis (RR=3.5, $p<0.001$) and respiratory tract diseases (RR=2.74, $p<0.001$) and only weakly associated with the risk of neonatal dermatitis (RR=1.1, $P=0.69$), neonatal jaundice (RR=1.2 $P=0.62$) and conjunctivitis (RR= 1.3, $P=0.43$). Furthermore, babies delivered by Caesarean sections were twice as likely to visit the hospital for non-scheduled review visits compared with those delivered vaginally. **Conclusion:** Caesarean birth is associated with poor early infant health outcomes and quality of life compared to vaginal birth.

Keywords: neonate sepsis; allergy; respiratory tract diseases; neonate conjunctivitis; caesarean section

Introduction

The rates of Caesarean delivery have been increasingly steadily across the years in the developed world [1,2], and similar trends appear to be emerging in low and middle income countries [3]. There is a myth that those caesarean sections are safer, quicker and less painful compared to vaginal deliveries [4]. A study involving some Ghanaian women showed that although vaginally delivery was still very popular, more than 53% of respondents had a very favourable opinion of Caesarean delivery [5].

Many women find it very convenient and appealing because parents get to choose the date of birth of their child and health workers can efficiently deliver more babies in a short time. It can be quite rewarding for the clinician, especially in health systems where remunerations are paid based on the number of deliveries. This convenience and financial motivation may fuel the tendency of the physicians to opt for and recommend Caesarean delivery even without clear medical justification.

Some studies have shown that women with a history of previous Caesarean section are about 95% likely to undergo a repeated Caesarean section for any subsequent pregnancy [6]. Although Caesarean delivery may be lifesaving for some mother-baby pairs, the World Health Organization (1985) has specified that Caesarean section rates above 15% cannot be justified in any way [7]. Furthermore, a number of studies have demonstrated some inherent risk with Caesarean section. This includes high maternal morbidity and mortality, longer hospitalizations, post-surgical wound infections and septicaemia [8,9,10,11]. Addition, epidemiological studies in some communities have shown that infants delivered by Caesarean may be at higher risk of allergic and atopic diseases in later life [12,13].

There has been increased interest in the role of micro-organism in the programming of immunity and metabolism. Subsequently microorganism composition or microbiome contribute significantly in the development of many immunological and metabolic disorder [14,15]. It is widely

hypothesized that Caesarean delivery does not offer the neonate essential microorganism from the mother's birth canal. We had previously shown that perinatal antibiotic use (24 h to delivery) was associated with lower mean Apgar scores [16]. The microorganism deprivation is further enhanced by peri-natal use of broad-spectrum antibiotic as adjuncts to Caesarean section.

Although there have been several studies on Caesarean section in sub-African, very few of such studies involved follow-up focused exclusively on the health of the infant. Data is still being accumulated on immediate and delayed health implications Caesarean section on infant health. This study compares the health outcomes between infants (not more than 90 days) delivered by Caesarean section and vaginal route in a rural community in the Ashanti region of Ghana using dermatitis, clinical sepsis, respiratory tract diseases, neonatal conjunctivitis, neonatal jaundice and number of non-review hospital visits.

Method

Study area

This study was carried out at a village called Dominase-Essumeyaman, in the Bekwai municipality of the Ashanti-region of Ghana. The study site, Seventh-Day Adventist Hospital, is about 25 km south of Kumasi, Ghana's second largest city. It is a small community-based hospital with a capacity of about 45-beds. It has a gynecological and obstetric unit that runs an antenatal and post-natal clinic for pregnant women and mother-baby pairs respectively. It has a gynaecologist, a pharmacist and several midwives and nurses. Although the cash and carry payment is allowed, most patients access healthcare through the Ghana National Health Insurance (NHIS) capitation policy.

Sample Size

The Bekwai municipality has a fertility rate (p) of 110.5 per 1000 women [17], and assuming a margin of error (d) of 0.05 and a Z value of 1.96 for a confidence level of 95 %, a minimum of 151 folders of pregnant women were required for the study using the mathematical equation by Cochran (1977) [18].

Study design, population and Analysis

This study was designed to determine the effects of Caesarean delivery on the health of the infant within the first three (3) months of delivery. This design was a retrospective study of babies whose mothers attended the antenatal care clinic and who were delivered there and attended postnatal clinic as well at Seventh-Day Adventist Hospital, Dominase (SDAHD). Babies after delivery shared the same folder with their mother within the first three (3) months. For this study, mother-baby pair folder numbers from January 2011 to December 2015 were obtained from the maternity unit. Five hundred (500) folder numbers were randomly selected for each of the five (5) years. A total of 2500 folders was subsequently anticipated. However, the biostatistics and records department were able to produce only 2100. After applying the inclusion and exclusion criteria, only 412 mother-pairs records met the criteria and were used for the study.

Indicators of Neonatal Health as study outcome

The incidences of dermatitis, respiratory tract diseases, clinical sepsis, neonatal jaundice, conjunctivitis and number of hospital visits were used as predictors of neonatal health. Physician diagnosis was extracted and treated exactly as obtained from the medical folders. For this study, respiratory disorder was defined as any condition related to the respiratory system such as rhinitis, chest infection, pneumonia, and bronchiolitis. No distinction was made between infectious and allergic respiratory tract diseases, hence rhinitis, chest infection, pneumonia, bronchiolitis and any other condition related to the respiratory tract were considered as a respiratory tract disease. Impetigo, dermatitis and eczema were all categorized as dermatitis.

Neonatal conjunctivitis was defined to include neonatal conjunctivitis, septic or bacterial conjunctivitis, allergic conjunctivitis and ophthalmia neonatorum. The mean number of postnatal hospital visits was limited to only to non-review and non-scheduled postnatal visits.

The Inclusion criteria were as follows

- The patient should have attended at least three (3) antenatal (ANC) visits at the hospital after confirmation of pregnancy either by ultrasonography or Human Chorionic Gonadotrophic (HCG) detection method.
- Should have delivered a live singleton baby at the facility.
- Attended at least two post-natal hospital visits at the facility

The exclusion criteria were as follows

- Twin gestation was excluded even if the patient attended ANC and delivered at SDAHD
- Mother-baby pairs with no records or scanty postnatal records
- Deliveries of referral cases from other hospitals

Ethics approval

Approval for carrying-out this study was given by the hospital management committee of Seventh-Day Adventist Hospital, Dominase. Ethical clearance was also given by the Committee on Human Research, Publications and Ethics, Kwame Nkrumah University of Science and Technology, School of Medical Sciences and Komfo Anokye Teaching Hospital, Kumasi. Consent from individual respondents was not feasible since the primary source of data was the medical records of patients filed in the hospital. Names of respondents were excluded from the study during data collection to protect patient's confidentiality and protect their privacy.

Limitations And Confounding Factors

The study could not estimate the impact of pre-existing maternal condition before delivery on the health of the neonate. With the exception of antibiotics, the effect of any maternal medicine, nutrition, substance abuse during pregnancy on the health of the infant could not be accounted for in the study. The integrity of foetal membranes was not accessed and accounted for in this study. Cearean section in this study was not classified as emergency or elective.

Statistical analysis

Data from patients medical records were first captured with a specially designed form and later scrutinized, collated, analyzed using the IBM Statistical package for Social Sciences (SPSS) version [21]. Graphical and tabular representations of results were made using Microsoft Office (2013) and Graph Pad Prism (version 6). The Pearson Chi-square was used to analyze data of categorical variables such as the presence or absence of a disease condition. Student's t- Test and One-way ANOVA followed by Bonferroni post-hoc test was used to analyse the difference in mean values. The Relative Risk (RR) was used as an indicator of the degree of association between a condition and comparable groups.

Results

Respondents Socio-demographic characteristics, Mode of delivery and Antibiotic Use

In the study, 26.7% of all pregnancies went through Caesarean section. Older women were more likely to go for Caesarean section than younger women. 110 babies were delivered by Caesarean compared to 302 by vaginal delivery. 94.5% of mothers who delivered by Cearean were administered antibiotics at some stage during pregnancy compared with 55.3% of mothers who delivered vaginally. A proportion of mothers (5.5%) went through Caesarean without antibiotic treatment. Marital status, occupation, gravida

and religion did not affect the chances of a woman undergoing Caesarean procedure (Table 1).

Method of delivery and Neonatal Health

Respiratory Tract disease- Caesarean delivery was significantly associated with Respiratory Tract Diseases. The Relative risk was 2.74 when compared to vaginal delivery after adjusting for maternal antibiotic use and maternal socioeconomic factors. A mothers age, gravida, her occupation did not significantly affect the odds of infant developing respiratory diseases (Table 2).

Neonatal Sepsis- Infants delivered by Caesarean procedure were at a statistically significant risk of developing sepsis ($p < 0.001$). The relative risk was 3.5 times high when compared to babies delivered vaginally after adjusting for maternal antibiotic use. The risk was independent of a mother's socioeconomic class, age or previous pregnancy (Table 3).

Neonatal conjunctivitis- Caesarean delivery was only weakly associated with the risk of neonatal antibiotic therapy. The relative risk was 1.35 when compared to children delivered vaginally. This was not statistically significant ($P = 0.43$), (Table 4)

Table 4: Effects of Mode of delivery on some Infant Health Indicators

Dermatitis. The risk of neonatal dermatitis was weakly associated with Caesarean section delivery. Infants delivered by Caesarean were 1.1 times at risk of dermatitis compared to children delivered vaginally. The p-value was $P = 0.689$. (Table 4)

Neonatal jaundice. After adjusting for maternal antibiotic use, there was a weak association between Caesarean delivery and the risk of neonatal jaundice. The relative risk was 1.2 and the p value was $P = 0.624$. (Table 4)

Number of Hospital Visits- Infants delivered by Caesarean section were two times likely to report to the hospital for any health-related condition compared to vaginally delivered babies i.e., 1.0377 ± 1.27 vs 0.54 ± 0.88 (95%CL, $p = 0.001$, $F = 12.33$) (Table 4). The hospital visits were non review/nonscheduled visits from the time of birth till Ninety days after delivery. This was not affected by maternal socioeconomic factors.

Discussion

The Caesarean section rate among the women studied was 26.7%, which is beyond the WHO acceptable limits of 10-15% (WHO, 1985) [7]. In that very report, the World Health Organization stated that there was no possible justification for rates higher than 10%. The increase in caesarean rates may be fuelling itself since nulliparous women who go through caesarean section have a higher probability of going through it again in the subsequent deliveries [19]. The preponderance of caesarean section increased with increasing age of mother at birth as seen in this study and this is consistent with studies elsewhere [20,2]. Consistent with studies elsewhere, maternal factors such as gravidae, occupation, religion were not significantly associated with caesarean section [22].

The likelihood of dermatitis and conjunctivitis were slightly higher in babies delivered by caesarean birth than those by vaginal birth. It has been shown in some studies that the skin microbiome of vaginally delivered babies is different in microbial composition to that of Caserean delivered babies. Whereas the skin of vaginally delivered babies was colonized predominantly by organisms associated with the birth canal ie. *Lactobacillus* spp., *Prevotella* spp., *Atopobium* spp., or *Sneathia* spp, Caesarean delivered babies predominantly harboured *staphylococcus* spp., *Corynebacterium* spp., and *Propionibacterium* spp. either from maternal skin microbial colony or organisms in operating theatre [23,24,25]. This difference may be very significant since maternal skin microbiome is associated with increased susceptibility to allergic and infectious diseases alike [14,15].

However, in conjunctivitis, it was anticipated that vaginally born babies will be at a higher risk since the transmission of chlamydia trachomatis and other organisms implicated in conjunctivitis were acquired vertically from mother during birth [26]. Our findings could have been confounded by the practice of given antibiotic drops (gentamycin or Chloramphenicol) prophylactically as a standard practice at the labour ward. The Caesarean delivered babies were also at an increased risk of neonatal jaundice as previously reported by Gale et al., (1990) [27]. However, the association between Caesarean delivery and neonatal jaundice in our study was quite minimal.

Caesarean delivered babies were at a much higher risk of suffering from respiratory morbidities compared to their vaginally born babies. It could be argued that respiratory problems may not necessarily be due to the mode of delivery but infections in the operating theater in a low-income community. However, Signore and Klebanoff (2008) [28] reported similar findings elsewhere in the United States and hence given credence risk to a higher infant respiratory risk with Caesarean delivery.

Neonatal sepsis has been identified as the leading cause of neonatal death [29,30]. Our study identified suspected or clinical sepsis as the major neonatal health risk associated with Caesarean delivery. Such babies were more likely to be hospitalized. Furthermore, the extended hospital stay for babies could predispose them to a high risk potentially harmful microbe. Since Caesarean section rates are expected to increase [1], it will be appropriate for clinicians to provide a much greater care in protecting these babies against neonatal sepsis.

Generally, it was also observed that vaginally born babies were least likely to visit the hospital within the study period to seek medical attention. This probably may be an indication of a better programmed immunity and hence good neonatal health

Conclusion

Caesarean birth was associated with poorer neonatal health and babies born by that method are more likely to seek medical attention than those by vaginal delivery.

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