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Implementing Labor Analgesia Program in Low-Resource Settings: The Experience from a Major Teaching Hospital in Rwanda, 2023

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ABSTRACT

INTRODUCTION: Despite the high demand for pain relief during labor, access to labor analgesia remains limited in low-resource settings due to different challenges such as shortage of staff, inadequate equipment and supplies, insufficient training, high cost, and lack of local protocols. This project aimed to evaluate the feasibility of implementing a labor analgesia program at a major teaching hospital in Rwanda.

METHODS: This was a quality improvement project testing the implementation of the first labor analgesia program at the University Teaching Hospital of Kigali from August 2019 till July 2023. Descriptive statistics in Microsoft Excel (2010) were used for analysis.

RESULTS: 153 women underwent labour analgesia during our evaluation period. All women had adequate pain control (100%). Most women underwent epidural 136 (88.9%), followed by combined spinal epidural 13 (8.5%), and single-shot spinal anesthesia 4 (2.6%). Most labour analgesia procedures were conducted by anesthesiologists with residents 98 (64%) or anesthesiologists alone 45 (29.4%).

Most women had spontaneous vaginal delivery 102 (67%), however, 51 women had cesarian section (CS) mainly due to non-reassuring fetal heart rate (FHR) 30 (58.9%) and labor arrest 10 (19.6%). Most of them had no maternal or neonatal event 44 (86%). No post-dural puncture headache, infection, or epidural hematoma was recorded.

CONCLUSION: The results of this quality improvement project suggest that labour analgesia is feasible in low-resource settings and highlight essential areas for improvement, such as staffing and availability of equipment. This project provides valuable lessons for other anesthesiologists and hospitals in similar settings aiming to establish labor analgesia programs. More investments are needed in order to sustain and expand the labour analgesia program for women in low-resource settings.

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INTRODUCTION

Childbirth pain management is a critical aspect of obstetric care, ensuring the well-being and comfort of both mothers and infants during labor. In Rwanda, as in many low-resource settings,

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there is a growing recognition of the importance of providing effective pain relief during labor [1-4]. However, the availability and utilization of labor analgesia services remain limited in many healthcare facilities, including tertiary centers. This is due to too few anesthesiologists, insufficient equipment and medications, and cultural barriers as described in similar settings [1-4]. This deficiency contributes to unnecessary suffering among laboring mothers, impacting their overall birth experience, and potentially contributing to negative maternal and neonatal outcomes [5]. The absence of comprehensive pain management strategies also reflects broader challenges in healthcare infrastructure and resource allocation.

While epidural analgesia is recognized as a gold standard for pain relief during labor and offers effective pain control with a favorable safety profile for both mother and baby, and higher rates of satisfaction, it has been shown to be challenging to implement in low-resource settings [6-9]. Some programs such as the one in Guyana used task sharing allowing non physician anesthetists to place epidurals due to the severe shortage of anesthesiologists, the negative cultural beliefs were addressed by health education initiatives, however, the shortage of resources (equipment and supplies) and staff (anesthesia providers and nurses) was a big barrier to the sustainability of the program [2].

To our knowledge, there was no labor analgesia program in any public hospital in Rwanda, including the University Teaching Hospital of Kigali (UTHK), prior to this project. In order to implement a successful labor analgesia program in Rwanda, an innovative implementation strategy was needed with consideration of the local context [10]. This project aimed to evaluate the feasibility of implementing a labor analgesia program at a major teaching hospital in Rwanda.

METHODS

Design

This was a quality improvement project conducted from August 2019 to July 2023. The reporting followed the Standards for Quality Improvement Reporting Excellence (SQUIRE) guidelines [11].

Settings

This project has been implemented at the UTHK, which is the major teaching and referral hospital in Rwanda, located in Kigali. The maternity department has 2 operating rooms and 10 labor beds with cardiotocography (CTG) monitoring, staffed by 40 midwives, 15 obstetricians, 20 rotating obstetric residents, 12 non-physician anesthetists, 20 rotating anesthesia residents, and 2 anesthesiologists. The maternity department conducts more than 2,400 deliveries annually, and half of them under caesarean section.

Program Design

Prior to January 2018, at the start of this project, labor analgesia was almost non-existent at the UTHK maternity department. Before the establishment of the labor analgesia program, our team including Dr Edouard Uwamahoro, Dr Servent Izabayo, Dr Eugene Tuyishime, and Prof. Adeyemi J. Olufolabi, visiting professor from Duke University, USA, conducted a pilot survey to evaluate patients and healthcare providers' perception about labor analgesia before the initiation of a context relevant labor analgesia program. While surveying healthcare providers (98 in total) from the maternity service including 47 doctors, 39 midwives and 12 non-physician anaesthetists, 86 (88%) believed that labor pain was severe and should be managed, but 91 (94%) of healthcare providers described not having sufficient knowledge and skills in labor analgesia. We did not assess the availability of equipment and supplies because the administration ensured to avail them, especially that this was a new service.

We also surveyed patients on day 1 post-delivery (20 in total), 14 (70%) rated their pain as severe, 17 (85%) were not given any pain relief medication, 18 (90%) had never heard of pain medication for labor, and 16 (80%) felt medication should be available.

The results of this survey were presented to all members of the maternity department and the hospital administration, which provided support to test the implementation of the labor analgesia program while closing the identified gaps, especially a lack of skills.

Program Implementation

Our implementation strategy followed the 3 main steps below:

Guidelines and Protocols Development: First, in March 2018, our team developed the locally relevant labor analgesia guidelines.

Table 1: *Labour analgesia safety checklist*

Checklist Item	Details
Before Labour Analgesia	
Patient identification	Confirm patient name
Procedure to be performed	Epidural / CSE / Spinal
Consent	Anesthesia consent is obtained
Allergies	Check and record any allergies
Comorbidities	Note relevant conditions: pre-eclampsia, coagulopathy, cardiac disease, etc.
Platelet count	>75,000/mm³ for Epidural or CSE; >50,000/mm³ for Spinal
Anticoagulant/antiplatelet usage	Verify recent administration
Peripheral IV	Ensure it is functioning properly
Fetal status	Reassuring CTG tracing
Cervical dilatation	≥ 4 cm
After Labour Analgesia Procedure	
Monitoring every 5 minutes (first 30 min)	Blood pressure, heart rate, pulse oximetry (SpO_2)
Hourly monitoring	Pain score <3 (NRS), block level (T10 bilateral), vital signs (BP, HR, SpO_2), CTG assessment

CSE: Combined Spinal-Epidural, IV: Intravenous, CTG: Cardiotocography,, SpO_2: Peripheral Capillary Oxygen Saturation, NRS: Numerical Rating Scale, T10: Thoracic spinal nerve level 10

This guideline was intended to be comprehensive, including different documents such as the labor analgesia safety checklist (Table 1). The pain score evaluation used the existing numerical rating scale (NRS) adapted from the previous study done in Rwanda and translated into Kinyarwanda [10]. Both the labor analgesia checklist and protocol were posted in the delivery ward, and their copies were made available within patient charts.

Resources and Education: From March 2018 to August 2018, our team designed a labor analgesia trolley containing necessary medical supplies and drugs (Table 2). In addition, we ensured that necessary monitoring equipment (non-invasive blood pressure, pulse oximetry, and cardiotocography) was available. Moreover, we conducted regular morning staff teaching about labor analgesia, covering different topics such as guidelines and protocols, indications, techniques, drugs, monitoring, effectiveness, advantages, and complications of labor analgesia.

Implementation: From September 2018 to July 2019, our team initiated the labor analgesia program. Due to a shortage of anesthesia staff, the labor analgesia program was initiated only during day shifts, excluding weekends, by availing one anesthesiologist, one resident, and one non-physician anesthetist to offer the service. Regular feedback was requested from the labor analgesia team (midwives, obstetricians, non-physician anesthetists, anesthesia residents, and anesthesiologists), and mentorship was provided by the consultant anesthesiologist to the rest of the team. By the end of the implementation period, the final labor analgesia program was established with good feedback.

Table 2: *Labour analgesia protocol*

Medication / Technique	Dosage / Description
Paracetamol	1 g IV every 4 hours as needed
Tramadol	100 mg IM every 4 hours as needed
Spinal Analgesia Components	- Bupivacaine 2.5 mg - Fentanyl 20 mcg - Morphine 150 mcg
Epidural Analgesia	Intermittent bolus of 10–20 mL per hour of 0.125% or 0.0625% Bupivacaine with Fentanyl 2 µg/mL

IV: Intravenous, IM: Intramuscular

Program Evaluation

During the evaluation of our labor analgesia program, we evaluated the quality of labor analgesia from August 2019 to July 2023. This project was granted ethics approval by the UTHK Ethics Committee (Ref.: EC/CHUK/131/2023). We included all women with a viable pregnancy who requested neuraxial analgesia for labor at the maternity department at the UTHK. All participants provided their written informed consents prior to enrollment in the study. After signed consent, parturients were managed as per departmental protocol including paracetamol 1gm IV/4 hours as required and tramadol 100mg IM/4 hours as required followed by either single shot spinal analgesia (bupivacaine 2.5mg with fentanyl 25mcg), or an epidural or combined spinal-epidural analgesia maintained with intermittent bolus of 10 cc to 20 cc per hour of 0.125% or 0.0625% Bupivacaine and Fentanyl 2µg·ml. We excluded parturients who had incomplete information or non-neuraxial techniques of labor analgesia. We collected data on patients' characteristics, type of labor analgesia, labor analgesia provider, quality of pain control measured by NRS, complications, delivery mode, maternal outcomes, and neonatal outcomes.

Statistical Analysis

Data were entered electronically into an Excel spreadsheet from paper forms. Descriptive statistics were then used to report patient demographics and key variables. Data were analysed using Excel version 2010, and we reported the frequency and rate of occurrence of key variables such as level of labour progress, type of labor analgesia, profession of the health provider, level of pain control, delivery type, and complications.

RESULTS

One hundred fifty-three women underwent labor analgesia during our evaluation period, with 67% in the latent phase versus 33% in the active phase. All women had adequate pain control, 153 (100%), with a pain score < 3. Most women underwent epidural 136 (88.9%), followed by combined spinal epidural 13 (8.5%), and single shot spinal anesthesia (SSSA) 4 (2.6%).

Most labor analgesia procedures were conducted by anesthesiologists with residents, 98 (64%) or anesthesiologists alone, 45 (29.4%).

Table 3: *Characteristics of labour analgesia among 153 patients at the UTHK*

Criteria	Number (%)
Labor progress	
Latent phase	103 (67)
Active phase	50 (33)
Type of labor analgesia	
Epidural	136 (88.9)
CSE	13 (8.5)
SSSA	4 (2.6)
Health Provider	
Anesthesiologist alone	45 (29.4)
Anesthesiologist/Resident	98 (64.1)
Anesthesiologist/NPA	5 (3.3)
Resident/NPA	1 (0.6)
Resident	3 (2.0)
NPA	1 (0.6)
Adequate pain control	
Yes	100 (100)
No	0 (0)
Delivery type	
Vaginal	102 (66.6)
CS	51 (33.3)
Indications for CS	
NRFHR	(58.9)
Labour arrest	(19.6)
Others*	(21.5)
Post CS events#	
No	44 (86)
Yes	7 (14)
Labour analgesia utilization	
Yes	153 (1.3)
No	11384 (98.7)

**:Maternal request (8%), Abruptio placentae (8%), and Malpresentation (6%), #: vacuum extraction use (2.5%), perineal tear (2.5%), hypotension (1.3%), birth asphyxia (1.3%), fetal bradycardia (0.6%), bag mask ventilation for babies (11.8%), and NICU admission (7.2%), CSE Combined Spinal Epidural, SSSA: single shot spinal anesthesia NPA: Non physician anesthetist, CS: Cesarean section, NRFHR: Non reassuring fetal heart rate.*

Most women had spontaneous vaginal delivery 102 (67%), however, 51 women had cesarian

section (CS) mainly due to non-reassuring fetal heart rate (FHR) 30 (58.9%) and labor arrest 10 (19.6%). Most of them had no maternal or neonatal event 44 (86%). No post-dural puncture headache, infection, or epidural hematoma was recorded.
Overall, among 153 deliveries, 18 (11.8%) babies required bag mask ventilation and 11 (7.2%) were admitted to the Neonatal Intensive Care unit (NICU). There was no maternal or neonatal death during the evaluation period. No post-dural puncture headache (PDPH), infection, or epidural hematoma was recorded (Table 3).

DISCUSSION

Our findings demonstrate the feasibility of establishing a labor analgesia program in a resource-limited setting such as Rwanda. Achieving adequate pain relief (pain score of 0-3 among 100% of patients) and favorable maternal and neonatal outcomes suggest that with proper planning, training, and resource allocation, significant improvements in the quality of labor analgesia can be achieved.
Our findings are in line with results from multiple studies conducted in other low- and middle-income countries (LMICs) [12-22]. In sub-Saharan African countries such as Kenya, Nigeria, Ethiopia, Cameroon, and Ghana, there are ongoing efforts to implement labor analgesia programs despite resource constraints [12-22]. Labor analgesia programs in these countries face some challenges, such as a shortage of trained personnel, equipment shortages, and negative cultural beliefs [11-20]. In the Middle East, countries like Egypt and Jordan have implemented labor analgesia programs in select urban centers [21-22]. These initiatives benefit from comparatively better resources but face challenges related to cost, cultural acceptance, and disparities in access between rural and urban areas.
Our labor analgesia program faces challenges similar to those from other LMICs, requiring appropriate intervention [12-22]. Good progress has been made towards the right direction; our team developed appropriate protocols, trained a multidisciplinary team including anesthesia residents, NPAs, and midwives; and negotiated administration support for the availability of required equipment, supplies, and drugs.

However, there are remaining challenges explaining a very low utilization of labor analgesia (1.34%) in comparison to a 7.5% utilization rate in Nigeria and more than 80% in high-income countries [18], [23-26]. The UTHK still faces a shortage of anesthesiologists; for example, there is only 1 anesthesiologist dedicated to the obstetric unit and the gynecology list, making it difficult to offer labor analgesia while managing the cesarian sections and gynecology cases. In addition, the need to provide hourly bolus of bupivacaine by the anesthesiologist makes it also inefficient; there is a need to invest in current infusion pumps with ability to deliver patient controlled, programmed intermittent bolus, or continuous infusions which can be managed by midwives allowing anesthesiologists to manage other patients for efficiency use of their limited time [26]. Establishing specialized training programs such as obstetric anesthesia fellowships and formal obstetric anesthesia residency rotations can potentially increase the number of personnel dedicated to obstetric anesthesia and sustain the labor analgesia program at the UTHK.
Moreover, it is also important to consider the impact of the COVID-19 pandemic, which led to the pause and slowdown of the project from March 2020 until June 2021, where anesthesiologists were managing critically ill patients or clearing the surgical backlog from the COVID-19 pandemic.
Another challenge our team observed during the implementation and supported by the literature is the low price of the epidural program at the UTHK ($7 per procedure). While the low price has the intention to make this service affordable, this leads to an unintended consequence of lacking enough resources to run the program. There is a need to negotiate a true market price of this important service based on other low-resource settings like Nigeria, with a higher but reasonable price of $35 [14].

The financial model used to run the labor analgesia program at King Faisal Hospital (KFH) and some private hospitals in Rwanda should also be examined. Lessons learned applied to the situation of CHUK while considering the difference in settings where CHUK receives mainly patients with public insurance and with a low-income background. In contrast, KFH and private hospitals usually care for high-income patients with private insurance.
It may be reasonable to initially implement labor

analgesia at CHUK as a private practice before investing in the return on investment in the public labor analgesia program.

No patient should suffer from manageable pain while in the hospital, as recommended by different regulatory and advocacy organizations [27-29]. On top of that, these investments in labor analgesia also have the potential to contribute to the overall quality of care and outcomes because the obstetric anesthesia team will be involved in care of all pregnant women earlier, allowing timely optimization of comorbidities, recognition of complications, and establishment of labor analgesia and anesthesia plan. Another potential benefit is the reduction of the cesarean section rate and cost as demonstrated in similar settings [30], [31]. However, cultural beliefs and patient preferences may influence acceptance and uptake of labor analgesia services [32], [33]. Addressing misconceptions and providing education to both healthcare providers and patients is crucial. More community outreach and education programs are needed to raise awareness about the benefits and safety of labor analgesia.

More importantly, the Rwandan Society of Anesthesia and Critical Care (RSACC) should conduct more advocacy efforts for policy changes and financial support from government health agencies to prioritize labor analgesia in the national healthcare agenda. Some effective interventions in low-resource settings, such as task shifting and single short spinal anesthesia, should be tested in Rwanda and other similar settings [20], [34], [35].

There are multiple limitations to consider while interpreting the results of this quality improvement project. It is limited by its single-center design and relatively short evaluation period. The generalizability of findings may be restricted to similar hospital settings in low-resource environments. Additionally, the reliance on retrospective data analysis may introduce bias.

CONCLUSION

The results of this quality improvement project suggest that labor analgesia is feasible despite the challenges of a shortage of anesthesiologists and equipment.

We recommend that public hospitals and their stakeholders, such as health insurance, promote access to labor analgesia by providing appropriate funding for affordable equipment, supplies, and drugs, and ensuring a sustainable funding model considering the local context and the market value of the labor analgesia service. In addition, public hospitals and the Ministry of Health should implement innovative solutions such as the 4 x 4 program to provide adequate staffing for the labor analgesia program within teaching hospitals. Moreover, the Rwanda Society of Anesthesia and Critical Care (RSACC) should design policies and guidelines for adequate labor analgesia in Rwanda in collaboration with key stakeholders such as the Ministry of Health.

By implementing these recommendations, labor analgesia has the potential to become more accessible in Rwandan public hospitals, leading to higher quality of care for pregnant women, which is a priority for the Ministry of Health.

Lessons learned from this project can also be applied in other low-resource settings. Further quality improvement projects should evaluate the feasibility, cost-effectiveness, accessibility, and sustainability of the labor analgesia program in different public hospitals in Rwanda.

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