Research Article

Quantitative Study, Induction of Labour at Mildura Base Public Hospital, Mildura, a Regional City in North-West Victoria, Australia

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Abstract

This report discusses Induction of Labour induction (IOL), its global prevalence, and techniques that may be utilised. It provides a critical review of their comparative effectiveness and clinical outcomes. It also provides a perspective of regional Australian hospital practice, demonstrating the implications of induction of labour before and after the COVID pandemic.

Introduction

Labour induction is an integral obstetrical procedure that initiates the onset of labour in an otherwise undelivered pregnancy. The clinical decision to proceed with IOL typically follows a risk-benefit analysis of maternal and neonatal factors favouring proximate delivery over expectant management. The rate of IOL exhibits considerable variability worldwide [1]. Global Prevalence and Trends demonstrate that IOL rates range from approximately 27% in the United States to around 33% in certain European nations, 20% in the United Kingdom, and as low as 6% in developing countries like Nigeria [2]. In Australia, there has been a marked upsurge in IOL rates among first-time mothers, escalating from about 30% in 2010 to over 46.8% in 2019. In 2019, Victoria reported the highest rate among Australian states (51%), with major metropolitan areas demonstrating higher IOL prevalence than regional and remote areas [3].

The increasing trend towards Induction of labour may stem from a growing awareness of the risk associated with post-term deliveries and the complications of comorbid conditions, including advanced maternal age, diabetes, and hypertension [4]. Post-term pregnancy is the most common medical indication for IOL, while patient preference often underpins non-medical or 'social' inductions [4].

IOL methods are multivariate, encompassing mechanical and pharmacological approaches. The most appropriate method depends on cervical status, patient parity, expectations, and provider preference. Amniotomy, a procedure involving the rupture of membranes, is a simple and ubiquitous method used worldwide. It promotes the descent of the presenting part and the onset of labour with effective, coordinated uterine activity, although supporting evidence remains inconclusive [5]. Mechanical methods that stretch the cervical canal and, thereby, the amnio-chorionic membranes and myometrial cells have been pioneered for cervical ripening by stimulating endogenous prostaglandin production. They offer several potential benefits over pharmacological methods, including reduced caesarean delivery risk, improved safety profile in women with previous caesarean delivery, and cost-effectiveness [6]. However, they may increase the risk of maternal-neonatal infections, particularly with balloon catheter use [7]. Pharmacological agents such as prostaglandins and oxytocin have a long-standing history of use for IOL. Their advantage lies in their ease of application in the setting of an unripe or unfavourable cervix [6].

Despite being a fundamental obstetrical intervention, the outcomes of IOL may vary. When used appropriately or in the setting of a recognised indication for intervention, IOL is associated with improved outcomes. It is, however, not without consequence. Fewer than two-thirds of women induced will give birth without further intervention; approximately 15% will require instrumental delivery, and over 20% will have an emergency caesarean section [7]. With this perspective, a retrospective analysis of IOL procedures performed at Mildura Base Public Hospital in Victoria, Australia, was conducted to examine the outcomes of IOL. The results demonstrate the critical importance of individualised patient management, optimal method selection, and continuity of care to improve clinical outcomes.
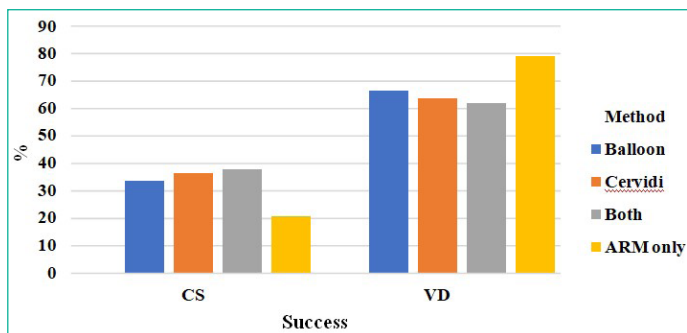
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Figure 1: Methods of IOL and Delivery Outcome.
Comparison of birth outcome for each IOL method. Findings show highest rate of vaginal delivery was in the ARM only group, P value <0.001.
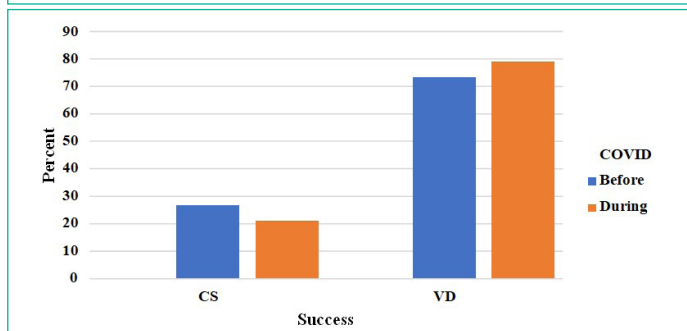

Figure 2: IOL during COVID-19.
Comparison of delivery outcomes before and during COVID-19 demonstrate a reduction of CS rate and increased likelihood of vaginal birth during COVID, with P values 0.022 and <0.001, respectively.

Endpoints

The primary endpoint was to compare the success rates of three commonly utilised methods of labour induction: Cervidil, balloon, and ARM. We aimed to provide an evidence-based assessment of their relative efficacy. The data also examined the effects of the COVID-19 pandemic on maternal and neonatal outcomes.

Materials and Methods

This is a retrospective quantitative study of pregnant women admitted to MBPH from January 2017 to December 2021 for IOL. Induction methods were selected based on clinical examination and patient/clinician preference. The patients were adult females with term pregnancies dated 37 weeks or beyond. De-identified data for the patients were matched with respect to age, BMI, gravity and gestational age at the time of IOL. There were four different methods of IOL in our study; balloon catheters (I), Cervidil (II), balloon catheters followed by Cervidil (III) and ARM (IV). A successful IOL was defined as one that led to the onset of labour either spontaneously or by AROM, leading to the delivery of a baby. The intended mode of delivery was vaginal but also included emergency Caesarean section if

Table 1: Incidence of induction delivery for each year.

Year	Total births	Births with Induction
2017	898	287(31.96%)
2018	839	283(33.73%)
2019	852	284(33.33%)
2020	823	261(31.71%)
2021	861	234(27.18%)

From January 2017 to December 2021, a total of 4,273 births occurred. Of these, 1,349 had IOL (31.6%). This incidence compares favourably with National and state averages. The rate was highest at 33.73% in 2018 and lowest in 2021, when it was 27.18%. There was no significant difference between number of Inductions performed in publicly or private practice: 31.8% compared to 30.2%, respectively, with a P value of 0.269.

Table 2: Comparison of risk factors and outcomes of IOL in the five years.

All five years		Balloon (I)	Cervidil (II)	Both (III)	ARM only (IV)	P value
RISK factors	No	50(35.7%)	54(31.2%)	11(37.9%)	696(69.1%)	<0.001*
	Yes	90(64.3%)	119(68.8%)	18(62.1%)	311(30.9%)	
Failed Induction	No	137(97.9%)	161(93.1%)	27(93.1%)	993(98.6%)	<0.001*
	Yes	3(2.1%)	12(6.9%)	2(6.9%)	14(1.4%)	
Success	CS	44(32%)	51(31.7%)	9(28%)	196(19.7%)	<0.001*
	VD	93(68%)	110(68.3%)	18(72%)	797(80.3%)	
Complications	No	107(76.4%)	112(64.7%)	22(75.9%)	765(76%)	0.017*
	Yes	33(23.6%)	61(35.3%)	7(24.1%)	242(24%)	
Duration of Induction	Median IQR	22 (19-26.4)	22 (16.1-26.8)	33 (23-48.5)	7 (4.5-10)	<0.001*

indicated by complications arising during labour. A failed IOL was defined as a procedure that did not lead to labour or the ability to initiate labour by additional means. In patients where IOL was successful, data was collected on the duration of labour from the time of ARM to delivery. The type of delivery was examined, whether spontaneous vaginal or assisted with instruments such as forceps or ventouse, or whether it was an emergency caesarean section because of either failure to progress or foetal distress. Complications of labour were recorded, such as uterine hyperstimulation, uterine rupture, hypersensitivity reactions, abnormal CTG, placental abruption, amniotic fluid embolism, gastrointestinal disturbances and vaginal irritation or cord prolapse. Birth complications include postpartum haemorrhage (blood loss of more than 500 ml) and significant vaginal trauma, particularly if it requires (EUA) examination under anaesthesia in theatre or shoulder dystocia.

Statistical Method

Statistical Package for Social Sciences (SPSS) Version 22.0 was used for data management and analysis. Descriptive statistics were performed for parametric quantitative data by mean, standard deviation and minimum and maximum of the range, and categorical data by percentage and number. Parametric quantitative data between groups was analysed by independent sample t-test. The Mann -Whitney test was used for non-parametric quantitative data. Analyses of qualitative data was performed using the Chi-Squared test. Correlation between two quantitative variables used Pearson's correlation coefficient and for a qualitative ordinal variable the non-parametric Spearman's rho correlation coefficient was used which ranged from (0-1): weak (r=0- 0.24), fair (r=0.25 -0.49), moderate (r=0.5- 0.74), strong (r=0.75-1). Logistic regression analysis was performed to determine the best method for IOL. The level of significance was taken at P value<0.05.

Table 3: P values between methods compared.

All five years	I vs II	I vs III	I vs IV	II vs III	II vs IV	III vs IV
RISK factors	0.401	0.821	<0.001*	0.474	<0.001*	<0.001*
Failed Induction	0.048*	0.204	0.452	0.994	<0.001*	0.071
Success	0.600	0.653	0.001*	0.875	<0.001*	0.027*
Complications	0.025*	0.948	0.905	0.241	0.002*	0.989
Duration of Induction	0.564	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

Balloon (I), Cervidil (II), balloon followed by Cervidil (III) and ARM (IV).
P values were calculated comparing each of two methods. ARM performed significantly better than other interventions when measured in terms of duration of treatment, successful delivery outcome and the rate of complications.

Table 4: Significance of maternal age, BMI and parity.

All five years		CS	VD	P value
Age	*Range* *Mean ± SD*	(17-46) 29±5.4	(16-45) 29.1±5.3	0.937
BMI	*Range* *Mean ± SD*	(19-48) 29.6±7.1	(13-49) 28.1±6.5	0.044*
Gravidity	*Median* *IQR*	1 (1-2)	2 (1-4)	<0.001*
Parity	*Median* *IQR*	0 (0-0)	1 (0-2)	<0.001*
Duration of Induction	*Median* *IQR*	16 (9-26)	9 (5-18)	<0.001*

Statistical analysis of age, BMI, gravity, and parity and their effects on delivery outcome. There is no significant effect related to age, however BMI significantly impacts the likelihood of Caesarean section. Multi-parity significantly increases the success of vaginal delivery. Vaginal delivery is also, significantly more likely when the duration of labour following IOL is shorter.

Results

A total of 1318 patients had a successful induction of labour during the study period. This number represents the patients who successfully moved into labour following an induction process regardless of the method or combination of methods, used. In contrast, the process failed in a total of 31 patients where induction of labour did not successfully progress to labour. These patients were delivered by LUSCS and are not included in subsequent calculations which examine delivery outcome following successful IOL.

For patients having successful IOL by balloon, 93 of 137 patients went on to successful vaginal delivery (67.8%) and 44 required CS (32.2%). In the Cervidil group, 110 of the 161 patients who successfully laboured had a vaginal delivery (68.3%) and 51 required CS (31.7%). There were 27 Patients who required two sequential methods of IOL - balloon followed by Cervidil. Twenty-five of these moved successfully into labour. Of them, 18 delivered vaginally (72%), and 9 (28%) by LUSCS. A total of 1007 patients required only AROM for induction. Of these, 993 (98.6%) moved successfully into labour, 797 birthed vaginally (80.3%) and 196 had a surgical delivery (19.7%).

The incidence of failed Induction was lowest (1.4%) in patients requiring AROM only. It was higher in patients induced using a balloon (2.1%) and greater still when Cervidil and the balloon were used sequentially (6.9%). Surprisingly, this rate was also found in patients who used Cervidil as a single agent.

Duration of Induction was calculated from the start of active labour to delivery of the baby. Induction was short (4.5-10 hours) when only AROM was required. It was equal for those having either a balloon or Cervidil induction (19-26.4 and 16.1-26.8 hours, respectively) and was most prolonged when more than one method was required (23-48.5 hours). Data analysed for the entire cohort included maternal age, BMI, gestational age, gravity and parity at the time of Induction. The average age was 29±5.4 years. The average BMI 28.5±6.7 and the average gestational age 38.9±1.9 weeks. The median Gravida for patients was 2 with IQR 1-3, and the median parity 1, with IQR 0-2.

Discussion

Induction of labour (IOL), is a core procedure of obstetric practice worldwide. It is involved in approximately 1.4–35% of all deliveries in the setting of recognized indicators of maternal and foetal risk [3,4]. The process encompasses two critical stages: cervical ripening and the initiation of regular uterine contractions [1]. IOL is predominantly utilised when concerns associated with continuation of pregnancy exceed those imposed by strategic delivery [2]. This is most evident in comparative studies examining Induction versus expectant management for women with post-term pregnancies. In this setting, IOL is associated with significantly reduced perinatal mortality, thus underlining the vital role of the intervention as an accoucheur for safe, effective pregnancy care [16,17].

A successful IOL relies on a comprehensive understanding of factors influencing the induction process. Among these, cervical favourability is pivotal, as specific cervical properties facilitate progression into labour and birth [18]. Therefore, assessing cervical readiness is imperative to predict the likelihood of successful progress towards vaginal delivery. The Bishop score, is a simple and effective method of determining cervical readiness. It is an additive score derived from digital examination of cervical tissue examining softness, position, dilation and effacement, and its relationship to the presenting part. The assessment is subjective and influenced by examiner experience, which may lead to potential bias and variability and thus question the true predictive value of the assessment. Despite this, however, it is widely used and is a critical arbiter of decision-making in contemporary practice [19].

This study was conducted by examination of data for patients undergoing Induction of Labour at Mildura Base Public Hospital. Mildura is a regional city in northwest Victoria, Australia. It is Located on the Victorian side of the Murray River, with a population in 2018 of 33,444 persons. When nearby Wentworth, Irymple, Nichols Point and Merbein are included, the estimated urban population expands to just under 52,000. The study period, from 2017 to 2021, included data from procedures occurring before and after the COVID pandemic.

The study revealed that Artificial Rupture of Membranes (ARM) was the most effective IOL method, particularly when performed following a stretch and sweep procedure antenatally-90% of patients who underwent successful AROM had this performed prior to the Induction process. A parameter of success included the duration of hospital stay from the commencement of Induction to discharge following birth. Patients having AROM for IOL had a shorter inpatient stay, making the process cost- effective and less intrusive for patients who were able to return home and to normal lifestyle much sooner. These patients were also more likely to have a vaginal delivery making recovery to normal living and activities of daily life much easier. In contrast, patients using Cervidil or the Balloon Catheter followed by Cervidil, were more likely to experience a vexatious labour with significantly higher failure outcomes, a finding which reflects the importance of Cervical ripening prior to the induction process. Patients where this had occurred spontaneously and thus required little medical intervention, were more likely to labour and birth successfully.

The cumulative LUSCS rate for patients having IOL was not statistically different to patient outcomes following spontaneous onset of labour [20]. This supports the assertion that IOL does not increase the risk of surgical delivery in labour. This is because the risks of iatrogenic intervention are balanced by those of ongoing morbidity in patients where expectant management is followed. In contrast, the likelihood of harm inherent to untreated risk, is much higher in the latter group. In other words, when used appropriately, patients undergoing IOL compliant with recognized guidelines of best practice, may expect birthing outcomes that are no worse and indeed, are likely to be better, than those managed expectantly.

The COVID-19 pandemic triggered extensive disruptions to global community and service provision. The health care industry was significantly affected. Face to face interactions became cautious and ultimately, grossly restricted leaving patients isolated and reliant upon unfamiliar communication platforms. Medical and nursing staff were a diminishing resource. Health service shortages became cumulative reflecting unassuaged trends in population morbidity. These and other factors led to reduced clinical activity and intervention. Indications for treatment became judicious and critically sanctioned unless urgent. Pregnant women were especially vulnerable. Despite no definitive evidence of changed susceptibility to COVID-19, pregnant women who contracted the virus were at higher risk of morbidity and mortality [8-12]. In remote settings such as Mildura, isolation and co-morbidities of demographic and socioeconomic hardship were more likely to have negative impact, making women particularly vulnerable. A systematic review and meta-analysis of middle- and low-income settings consistently demonstrate a rise in maternal mortality and stillbirth rates [13-15]. Because of this, the secondary objective of this study was to compare the outcomes of labour induction, before and during the COVID crisis. We found that the number of women having IOL during the COVID-19 pandemic did not significantly change compared to other years. This is surprising when we consider the attenuation of health resources at this time. We also note that during this time, IOL were more likely to be successful and that the incidence of C/S and complications were reduced. We suggest that this reflects determinations to ensure preservation of access to essential care when required. Conditions of harm or risk are inherent to pregnancy and were no less likely to occur during the COVID pandemic and may well have been more quickly recognized in the setting of hypervigilance associated with symptom surveillance. We also suggest that improved outcomes of care during this time reflected optimal use of IOL based on evidence-based guidelines for selective intervention which was essential to ensure best utilization of resources by patients who were thus most empowered to benefit from treatment.

Strengths Limitation of the Study

The key strengths of our study are size and design. The study used data from over 4000 births in our maternity services between 2017 and 2021. The study was, however, limited as these births occurred in a single site and therefore analysed patients predominantly from a single area who may not represent the broader population.

Future Study

To conduct a prospective study to compare the outcome of IOL between Balloon and Cervidil over three years in a broader community group.

Conclusion

Maternity Health Services aim to provide sensitive, individualised care to birthing women to ensure that for each, they remain central to any decision-making process that affects them and their baby. With this determination, the experience of labour and birth is most empowered to become a safe and joyful journey. Induction of labour is a common intervention offered during pregnancy. To be effective and safe, decision-making must be inclusive, it must provide evidence of intended benefit and accurately convey the concerns of potential harm and the alternatives that may reasonably be considered. The process used must be tailored to the needs of each woman and must be evidenced based. This study has added to such knowledge. It has shown that AROM is the best method for IOL when the cervix is favourable. Methods of IOL using either mechanical or pharmacological interventions may be equally effective when required. The decision for either is based on individual preference and risk assessment for each patient. The results of treatment during the COVID-19 pandemic demonstrate the advocacy of strict compliance with recognized guidelines of best practice. These show that when used appropriately, IOL is associated with favourable outcomes for both labour and birth.

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