



Intrapartum ultrasound and mother acceptance: A study with informed consent and questionnaire

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ABSTRACT

Introduction: Intrapartum ultrasound (IU) is used in the delivery ward; even if IU monitors the labouring women, it could be perceived as a discomfort and even as an "obstetric violence", because it is a young technique, not often well "accepted". A group of clinicians aimed at obtain an informed consent from patients, prior to perform a translabial ultrasound (TU). The aim of this study was to evaluate the acceptance of both translabial and transabdominal IU.

Methods: In this study, performed at the University Hospital of Bari (Unit of Obstetrics and Gynecology), were enrolled 103 patients in the first or second stage of labor in singleton cephalic presentation. A statistical frequency and an association analysis were performed. As a significant result, we consider the peace of mind/satisfaction and the "obstetric violence". IU was performed both transabdominal and translabial to determine the presentation, head positions, angle of progression and head perineum distance. During the first and second stage of labor, the ASIUG questionnaires (Apulia study intrapartum ultrasonography group) were administered.

Results: 74 (71, 84%) patients underwent IU and 29 had a vaginal examination (28, 15%). Significant less "violence" has been experienced with a IU (73 out 74/98, 65%) and only one person (1 /1, 35%) recorded that. On the contrary, 10 patients (10/29) perceived that "violence" (34, 48%) while 19 (65, 52%) did not respond on a similar way, after a vaginal examination (VE). More patients felt satisfaction (71 out 74/95, 95%) with the use of IU and only 3 (3/4, 05%) felt unease. A different picture was evident in the vaginal examination group. Only 17 patients (17 out 29/58, 62%) felt comfort while 12 (41, 38%) felt unease.

Conclusions: In our study, IU use is well accepted by most of patients, because it could reassure women about their fetal condition. Moreover, they can see the fetus on the screen, while the obstetrician is performing the IU and this is important for a visual feedback, in comparison with the classical VE.

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1. Introduction

Ultrasound is used throughout pregnancy. In particular, obstetric ultrasound plays a crucial role in the first trimester of pregnancy to verify the presence of soft markers for the recognition of genetic abnormalities, major malformative diseases in the second trimester and developmental diseases and fetal growth in the third trimester of pregnancy [1–3]. Ultrasound companies perform each of these procedures with the informed consent of the patient who is made aware of the objectives and limitations of each examination through the use of standardized forms at national level. Similarly, the use of intrapartum ultrasound (IU) is a technique that is being consolidated in order to optimize obstetric management during childbirth. This method can be performed both transabdominally (TU) and trans-rectally, among a population of women in the first and second stage of labour, in patients with or without neuraxial labour analgesia (NAL). Also for this procedure it may be necessary to obtain informed consent in order to understand the compliance of patients to perform obstetric ultrasound during labor and to inform the patient of the usefulness of this examination [4]. Therefore, in this study we evaluated the acceptance of IU in labor by subjecting 103 patients during the first and second stage of labor, the proposed informed consent and the ASIUG questionnaire (Apulia study intrapartum ultrasonography group) [5].

In our study, the use of IU in labor was well accepted by most patients and met with broad consensus, because it could reassure women in labor about their fetal condition as well as simplifying the understanding of the patient’s management [6–8].

Therefore, while waiting for the execution of intra-partum ultrasound to become a practice, with standardized consensus protocols this work confirms its usefulness and extreme acceptance by the patient. In addition, with the application of IU, diagnostic accuracy can be optimized in the future, by performing automatic measurements and assessments based on artificial intelligence (AI) that could also reduce examination time and improve workflow.

2. Materials and methods

In this study, performed at the University Hospital of Bari (Unit of Obstetrics and Gynecology), between March and November 2021, were

consecutively enrolled 103 patients in the first or second stage of labor in singleton cephalic presentation.

The exclusion criteria are: preterm birth, twin pregnancy, abnormal invasive placentation (placenta previa, placenta accreta); IUGR; uterine myomas or any case of emergency delivery such as eclampsia, prolapsed cord, severe infections, abruptio placenta, severe fetal distress.

The labor was managed in neuroaxial analgesia in labor when requested by the patient.

Intrapartum ultrasound was performed as previously described, both transabdominal and translabial to assess the presentation, head positions, angle of progression and head perineum distance [9].

During the first and second stage of labor, the proposed informed consent (Fig. 1) and the ASIUG questionnaire (Apulia study intrapartum ultrasonography group) (Fig. 2) were administered to patients.

For the Statistical Analysis categorical variables have been analyzed with Pearson Chi Square Test using JMP 13 (SAS) and $p < 0.05$ was considered statistically significant. All p-values were two tailed.

3. Results

103 patients were consecutively enrolled in this study. A frequency analysis (Table 1) and an association analysis (Table 2) were performed on each parameter. As response, we do consider the peace of mind/satisfaction and the “obstetric violence” experienced by the patients.

3.1. Intrapartum ultrasound vs vaginal examination and “obstetric violence”/piece of mind

74 (71, 84%) patients were subjects of intrapartum ultrasound and 29 of vaginal examination (28, 15%). When it comes to “violence experience”, significant less “violence” has been experienced from patients received intrapartum ultrasound (73 out 74/98, 65%) and only one person (1/1, 35%) recorded that. On the contrary 10 patients (10/29) responded that received “violence” (34, 48%) while 19 (65, 52%) patients did not respond in a similar way, when received vaginal examination. ($P < 0, 0001$) (Pearson Chi Square). When it comes to peace of mind/satisfaction significant more patients felt satisfaction (71 out 74/95, 95%) with the use of intrapartum ultrasound and only 3 persons (3/4, 05%) felt unease. A different picture was evident in the vaginal

Informed consent to the intrapartum ultrasound

PATIENT NAME AND SURNAME..... PLACE OF BIRTH.....

DATE OF THE BIRTH..... COUNTRY OF RESIDENCE.....

I HAVE BEEN INFORMED ABOUT THE POSSIBILITY TO PERFORM SOME ULTRASONOGRAPHY DURING MY LABOUR.

HOWEVER, I AM INFORMED ABOUT THE POSSIBILITY OF MAKING PHOTOS OR VIDEOS THAT COULD BE USED AT DIDACTIC AIM.

MOREOVER, I DECIDE TO ANSWER TO ASIUG QUESTIONNAIRE.

I AFFIRM THAT I UNDERSTAND THIS INFORMED CONSENT AND I ACCEPT :

A) THE US EXECUTION	YES NO
B) THE PERFORMANCE OF DIDACTIC MATERIALS (PHOTOS AND VIDEOS)	YES NO

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Fig. 1. Informed consent for IU.

APULIA STUDY INTRAPARTUM ULTRASONOGRAPHY GROUP (ASIUG)				
1.	Are you satisfied and/or convinced when the obstetrician or midwife report the result of the VE or when they let you see the IU?	YES	NO	
2.	The translabial intrapartum ultrasonography provoke discomfort?	YES	NO	
3.	Can the translabial ultrasonography provoke more discomfort compared to VE?	YES	NO	
4.	When the obstetrician affirms the necessity of vacuum extractor use, are you more convinced after VE or after IU?	VE	IU	BOTH
5.	When the obstetrician decides to perform a cesarean section, are you more convinced after VE or after IU?	VE	IU	BOTH
6.	In our opinion, does the IU make you more satisfied?	YES	NO	
7.	Does the IU provoke obstetric violence to you?	YES	NO	

Fig. 2. Apulia study intrapartum ultrasonography group (ASIUG) questionnaire.

Table 1
Frequency analysis for all parameters.

		N = 103	%
vaginal examination vs intrapartum ultrasound	intrapartum ultrasound	74	71,85%
	vaginal examination	29	28,16%
discomfort with intrapartum ultrasound	no	80	77,67%
	yes	23	22,33%
discomfort of intrapartum ultrasound > discomfort with vaginal examination	no	93	90,29%
	yes	10	9,71%
Decision for vacuum extraction with intrapartum ultrasound or with vaginal examination	intrapartum ultrasound	78	75,73%
	vaginal examination	20	19,42%
	both	2	1,94%
	no preference	3	2,91%
Decision for Cesarean section with intrapartum ultrasound or with vaginal examination	intrapartum ultrasound	84	81,55%
	vaginal examination	17	16,51%
	both	1	0,97%
Quiet/peace of mind	no	15	14,56%
	yes	88	85,44%
"Obstetrics Violence"	no	92	89,32%
	yes	11	10,68%

examination group. Only 17 patients (17 out 29/58, 62%) felt peace of mind while 12 (41, 38%) felt unease. (P < 0, 0001) (Pearson Chi Square) (Fig. 3).

80 (77, 67%) of the patients of intrapartum ultrasound did not experience discomfort while 23 (22, 33%) of them showed signs of discomfort. significant less" violence" experienced has been recorded (79 out 80/98, 75%) on these patients which did not experienced discomfort with intrapartum ultrasound. in parallel 10 out of 23 /43,

48% of patients that experienced discomfort with intrapartum ultrasound, reported this as "obstetrics violence" (P < 0, 0001) (Pearson Chi Square). When it comes in peace of mind/satisfaction 78 out of 80/97, 5% reported this from these patients that did not experience discomfort during intrapartum ultrasound, while only 10 out 23 patients (43, 48%) experience satisfaction/peace of mind from these patients who initially experienced discomfort during intrapartum ultrasound. (P < 0, 0001) (Pearson Chi Square).

3.2. Higher discomfort with Intrapartum ultrasound than vaginal examination

Only 10 (9, 7%) patients experience higher discomfort with intrapartum ultrasound than with vaginal examination. on the contrary the other 93 (90, 29%) patients did not report higher discomfort with intrapartum ultrasound. 88 out of 93/94,62% from the patients that did not experience higher discomfort with intrapartum ultrasound, experience quiet and peace of mind while none of them that experience higher discomfort with intrapartum ultrasound experience peace of mind (P < 0, 0001) (Pearson Chi Square). In parallel, 92 out of 93 (98, 92%) from the patients that did not experience higher discomfort with intrapartum ultrasound, did not experience "obstetrical violence" while all of them (10 out of 10) that experience higher discomfort with intrapartum ultrasound, reported "obstetrical violence" (P < 0, 0001) (Pearson Chi Square)(Fig. 4).

3.3. Which method justifies better an operative delivery? Intrapartum ultrasound or vaginal examination

When patients asked whether Vacuum extraction may be needed as a mean to delivery the majority of them feel secure about this decision with the use of intrapartum ultrasound (78/ 75, 72%) while 20 (19, 41%) with the use of vaginal examination. Three of them (2, 91%) expressed no preference while 2 (1, 94%) asked for both techniques.

Most important, when patients asked whether Cesarean section

Table 2
“Obstetrics Violence” and peace of mind experienced with the use of intrapartum ultrasound.

	Quite/peace of mind (no/yes)	ChiSquare (Likelihood Ratio/ Pearson)	P	Obstetrics violence (no/yes)	ChiSquare (Likelihood Ratio/ Pearson)	P
vaginal examination vs intrapartum ultrasound		21,056 23,329	< ,0001		22,034 23,975	< ,0001
Intrapartum ultrasound	73/1 (4, 05/95, 95%)			73/1 (98, 65/1, 35%)		
Vaginal examination	19/10 (41, 38/58, 62%)			19-ott (65, 52/34, 48%)		
Discomfort with intrapartum ultrasound		35,304 41,9	< ,0001		27,748 33,395	< ,0001
No	79/1 (2, 5/97, 5%)			79/1 (98, 75/1, 25%)		
yes	13/10 (56, 52/43/48%)			13-ott (56, 52/43, 48%)		
Discomfort of intrapartum ultrasound > discomfort with vaginal examination		46,544 64,975	< ,0001		58,937 92,63	< ,0001
no	5/88 (5, 38/94, 62%)			92/1 (98,82/1,08)		
yes	10/0 (100/0%)			0/10 (0/100%)		
Decision for Vacuum extraction with intrapartum ultrasound or with vaginal examination		50,366 61,31	< ,0001		31,565 40,235	< ,0001
Intrapartum ultrasound	1/77 (1, 28/98, 72%)			77/1 (98, 72/1, 28%)		
Vaginal examination	14/6 (70/30%)			10-ott (50, 50%)		
Both	0/2 (0/100%)			2/0 (100/0%)		
No preference	0/3 (0/100%)			3/0 (100/0%)		
Decision for Cesarean section with intrapartum ultrasound or with vaginal examination		58,808 75,202	< ,0001		36,107 49,475	< ,0001
Intrapartum ultrasound	1/83 (1, 19/98, 81%)			83/1 (98, 81/1, 19%)		
Vaginal examination	14/3 (82, 35/17, 65%)			07-ott (41, 18/58, 82%)		
Both	0/1 (0/100%)			1/0 (100/0%)		
No preference	0/1 (0/100%)			1/0 (100/0%)		

might be needed as a mean to delivery, the majority of them feel secure about this decision with the use of intrapartum ultrasound (84/ 81, 55%) while 17 (16, 5%) mentioned the use of vaginal examination. One of them expressed no preference while another one (0, 97%) asked for both techniques.

Overall 88 patients (85, 43%) experienced peace of mind and 15 (14, 56%) felt uneasy. Most Important 92 patients (89, 32%) did not experienced “obstetrics violence” while only 11 (10, 68%) recorded so (Fig. 5).

4. Discussion

From this study, it is evident that intrapartum ultrasound is perceived from the majority of patients, as an accurate technique that may guide to effective decision making. Patients experience less discomfort than the vaginal examination, and consider this technique to improve their piece of mind while experience less “obstetrics violence”. Obviously, the use of intrapartum ultrasound may serve as a leverage point to change the obstetrics practice at that point, although more data

are needed to establish the change to this direction. The dynamics of intrapartum ultrasound will be developed as data accumulate and more usefully connections with other parts of prenatal/postnatal care will be established. The main strength of this study is the clear evidence that is offered with the use of this technique, against vaginal examination. Obviously a larger sample size may strongly associate the concept of minimal observable obstetrics violence with the widespread of this technique. Certain important insight need to be better clarified in future studies and most of all to be prevented if we aim for a largely acceptance of intrapartum ultrasound from patients. All patients that experience higher discomfort with intrapartum ultrasound, reported “obstetrical violence” ($P < 0, 0001$) and none of them experience peace of mind ($P < 0, 0001$) (Pearson Chi Square). It is important to minimize the discomfort of the patients on first instance, with the use of intrapartum ultrasound otherwise it will be an undesirable bias in the acceptance of this technique. From the other side, patients felt more secure and experienced less “obstetrical violence” for a decision of an operative delivery, after the use of intrapartum ultrasound.

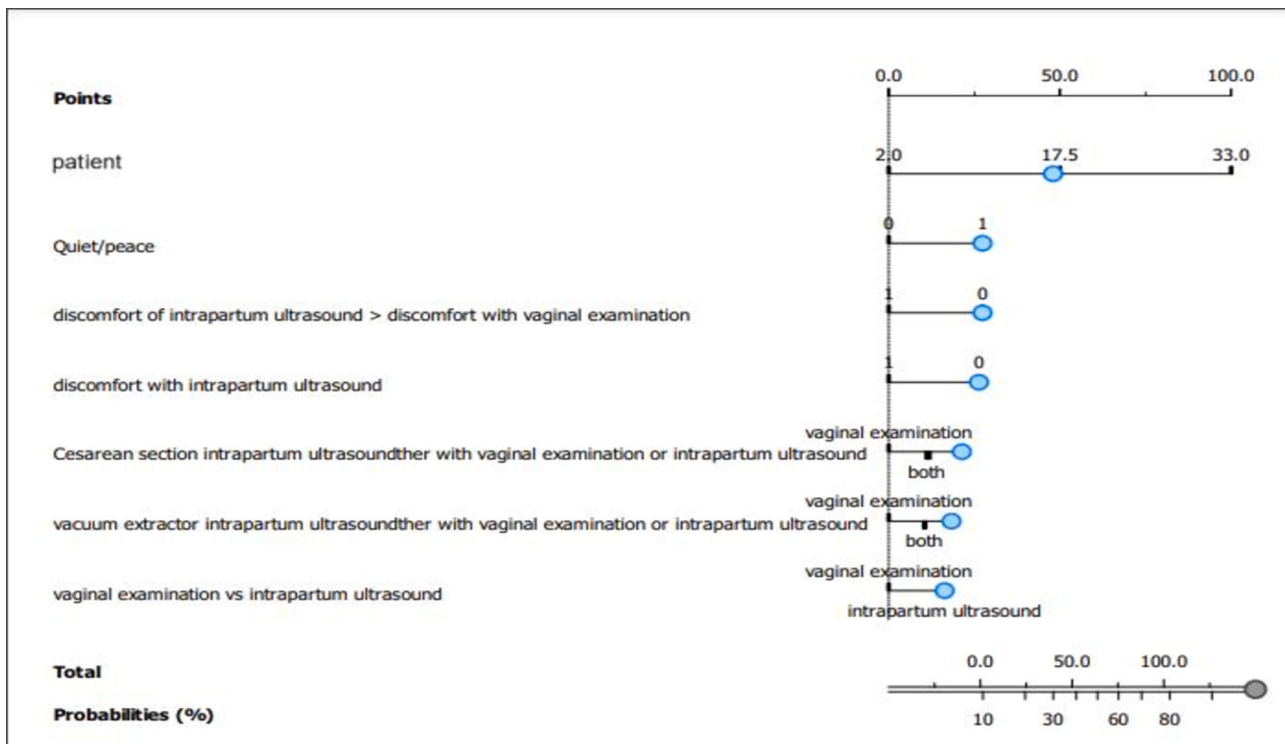


Fig. 3. Intrapartum ultrasound discomfort and “obstetrics violence”/piece of mind.

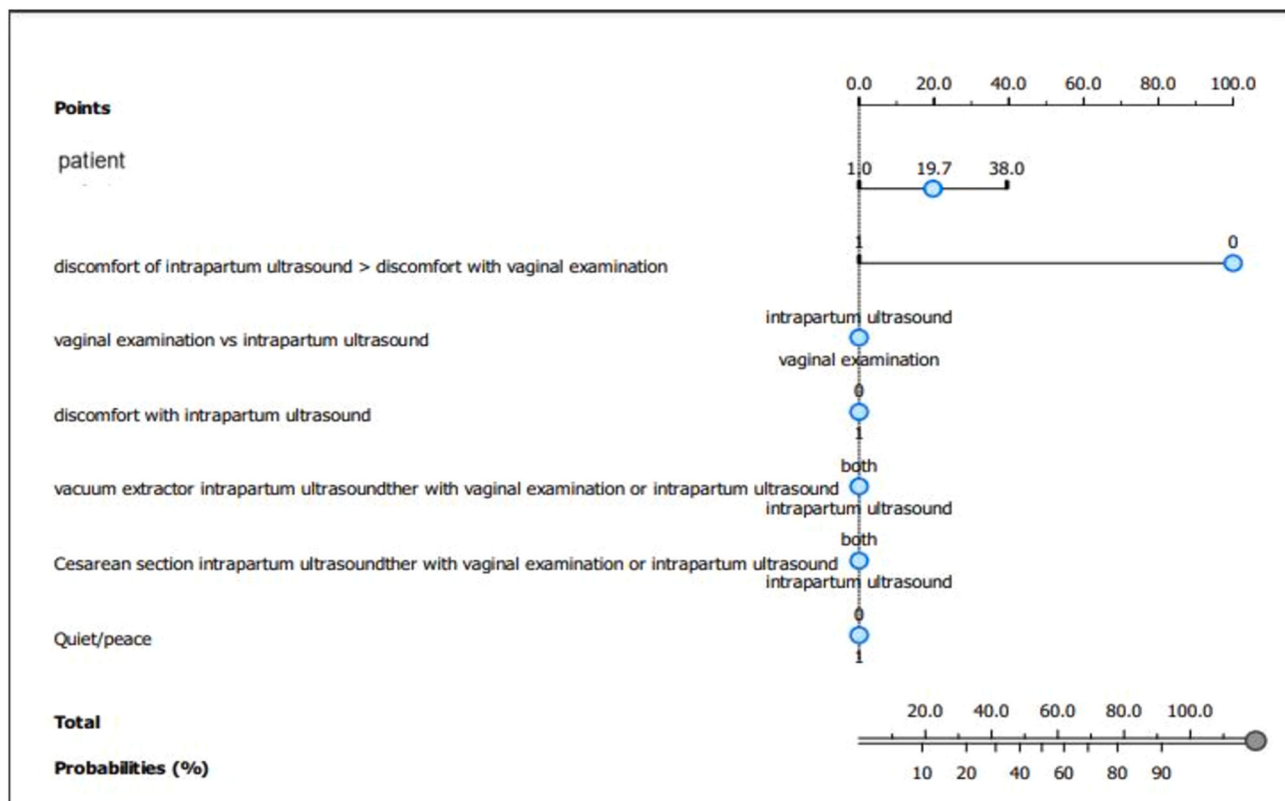


Fig. 4. IU and no violence patients' prediction.

4.1. Several studies support our findings

Wiafe et al. [10] conducts an analytical cross-sectional study among mothers who had both VE and TU during labour in a tertiary hospital;

they find that for most women ultrasound in labour was more tolerable than VE and TU should be an alternative to VE during labour. Usman et al. [11] in their first study assess the acceptability of VE and US. US assessment prior to delivery is more acceptable than VE. RA ameliorated

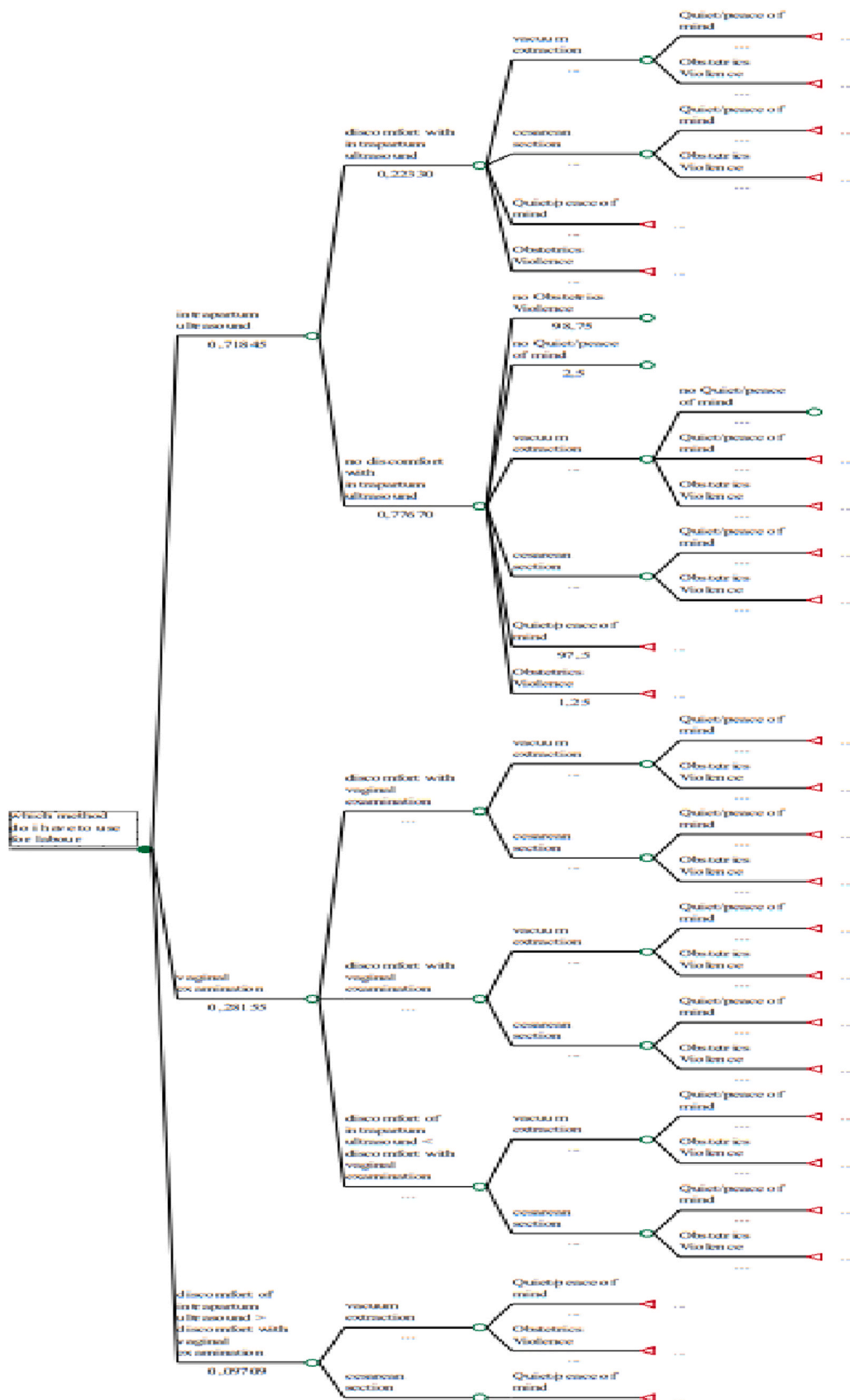


Fig. 5. IU decision tree.

the negative experience of the VE post-assessment. Seval et al. [12] find that perception of pain was significantly reduced with the use of a TU assessment compared with routine VE, but only during the latent stage of labor the observed effect was clinically significant. Wiafe et al. [13] aimed to examine the agreement between US and VE in assessing cervical dilatation in an African population and to assess the value of ultrasound in the diagnosis of active labor. They conclude that US measurements met agreement with VE in assessing cervical dilatation during labor and ultrasound may be used to detect active labor. Van Adrichem [14] et al. evaluate the intra- and interobserver variability of intrapartum ultrasound in nulliparous women in labor. US examinations were performed independently by a midwife and a gynecologist. They find that patients prefer ultrasound over VE; midwives tend to remain faithful to classical VE. Reproducibility of intrapartum ultrasound in non-experienced operators is good. Ilescu et al. [15] want to assess the acceptability of intrapartum ultrasound (IPUS) labor monitoring in unselected Romanian women in a tertiary maternity unit and the patients' experience of the examination; more than two thirds of the patients expressed increased confidence in the use of IU in the delivery room and they were willing to repeat the experience. Chan et al. [16] through the use of a pain score concludes that the IU is better tolerated than VE by patients. Both VE and IU are known to cause less discomfort under NLA. Malvasi et al. in their review analyze the important role of ultrasonography (US) related to the maternal outcomes in women with fetal persistent occiput posterior position (POPP) and asynclitism (A) in labor with neuraxial analgesia and conclude that the NAL let patients better tolerate both VE and IU, except in case of dystocic labour, when the pain is no more under control by analgesia [17,18]. Debska et al. [19] in their work underline that IU is a technique more and more used in the delivery ward; it can be useful to help in increasing the safety of labour, with the patients previously informed about the important role of IU, and an immediate consequence could be also the reduction of cesarean sections rate. Obstetric violence is recognized in some obstetric manoeuvres, in particular in Kristeller's manoeuvre and routine episiotomy. Some authors proposed a specific informed consent for episiotomy, to prevent the litigation liability and claim of "obstetric violence". For these reason, it is important a specific consent also for IU, particularly for UT [20–23]. Goli et al. [22] discuss about the obstetric violence in the delivery room in India; they find that it is a more common reality among women from socially disadvantaged communities. On the contrary, some authors want to underline the importance of maternal involvement during an obstetric ultrasound, underlying the role of US in the creation of maternal bonding. At bonding proposal, Jong-Pleij et al. [24] want to compare the effect of third trimester three-dimensional and four-dimensional (3D/4D) versus two-dimensional (2D) ultrasound (US) of the fetal face on maternal bonding. They find that bonding increases through the use of US. Rustico et al. [25] in their randomized study indicates that the addition of US in the antenatal care increases the maternal bonding toward their fetus. Youssef et al. [26] find that both 2D and 3D US are useful to assess fetal head-symphysis distance (HSD) in active labor. Gilboa et al. [27,28] investigate the effect of TU and of visual biofeedback on the parturient during second stage labour; they find that visual biofeedback improves women's pushing. Bellussi et al. [29] in their work also underline the usefulness of visual biofeedback through TU, to improve pushing during the active second stage of labor in nulliparous women. Sjömark J et al. results support the relevance of taking into account the fear of childbirth and perception of pain in connection with symptoms of PTS and PPD in nulliparous women. evaluate the effectiveness and cost-effectiveness of internet-based cognitive behavioural therapy compared with treatment-as-usual in women with negative birth experiences, posttraumatic stress and post-traumatic stress following childbirth, and to investigate whether partner support may add a beneficial. Gosselin et al. [30] in their study underline the importance of the fear of childbirth and perception of pain in connection with signs of post traumatic stress and post partum depression in nulliparous women. Niven et al. [31] in their work emphasize the

role of labor pain, that can evoke intense negative reactions in a few women, but also give rise to positive consequences related to coping, self-efficacy, and self-esteem. Rizzo et al. [32] assumes that IU is better tolerated than VE for assessment of labor progress; women's compliance with IU prior to delivery increased in the presence of prolonged labor or unplanned operative delivery. In the last decades, IU is always more often applied both in the delivery ward and in the delivery room, especially during dystocic labour [30]. In fact, IU determines fewer errors in the diagnosis of the fetal head position, in comparison to traditional vaginal digital examination (VE), especially in fetal head malposition in the birth canal [18]. ISUOG guidelines recommend the use of IU before operative vaginal delivery (OVD) [31]. The IU use lets a more accurate diagnosis that may reduce the materno-fetal complications. The US pelvimetry, with the measurement of the Angle of Progression (AoP), can also improve the diagnosis, thus reducing medico-legal consequences [33]. One aspect that worries women in labor a lot is the duration of labor and in particular prolonged labor. Although there is no international consensus on the definition and duration of pro-longed labour [34], currently the duration of labor is defined by the ACOG guidelines [35]. In last years, an ultrasound pelvimetry has been developed, which considers angles and distances, to evaluate the descent, internal rotation of the fetal head. The parameters most used in clinical practice are: the Angle of Progression [36], the angle of Internal Rotation [37], the symphysis pubis distance [38] and the direction of the fetal head in the pelvis [39,40]. Patients who labor under neuraxial analgesia (NLA) with visual feedback have more acceptance of a prolonged labour [41]. However, in case of prolonged and/or obstructed labor, after observing the ACOG guidelines, it is necessary to stop the drug administration and proceed to the operative delivery. Indeed, Beck et al. underlines that delayed NLA does not improve fetal head malposition and malrotation; on the contrary, there could be fetal and maternal complications with litigation, liability and claim [42].

In particular, in an operative delivery, Vlasjuk et al. underline the utility of IU in vacuum application in case of asynclitic position of fetal head in birth canal, because the misapplication of the cup can result in fetal head intracranial hemorrhage [43,44]; in the fetal head that hasn't rotated, the forceps use could be sometimes more useful [45].

Malvasi et al. demonstrates that the overdistention of the LUS by fetal head in malposition determine the structural alteration both in neurofibres and neurotransmitters [46,47]. This study was conducted during the COVID-19 [48,49] pandemic and biofeedback during pregnancy has been shown to reduce maternal anxiety, especially when the presence of relatives in the ambulatory wasn't allowed. In particular, the health care professionals have decided to use visual biofeedback during pregnancy as well as during labor [50–52]. Moreover, ultrasound has proved to be important to reassure women both in the gynecological and obstetrical field [53]. In particular, using audiovisual devices, with prior authorization from the Hospital Health Management, it was possible to record and send images relating to labor and the baby in real time to relatives, who could not access the delivery room [54,55].

In fact, during the pandemic relatives were prohibited from accessing both outpatient platforms and the delivery room; because of this, the hospital set up a room where relatives could see the images of the labor in progress in real time. Malvasi and Tinelli, in their experience of IU, subject to informed consent of the patient and authorization of the health management, used the smartphone to show the patient the malposition of fetal head detected through US and the correlation of this position during Cesarean Section [56]. After this clinical significative experience, they applied this system during Covid-19 pandemic, to create visual feedback between patients and distant relatives, thus helping to reduce patient anxiety. Moreover, women could also accept an eventual operative vaginal delivery with the use of IU [57].

5. Conclusions

In their experience, through an informed consent the authors conclude that IU is not a form of obstetric discomfort or in some cases “an obstetric violence”; on the contrary, it is well accepted by patients and meets a wide agreement, because it could reassure laboring women about the fetal well-being. Above all, they can also directly see the fetus on the screen while the obstetrician is performing the US and this is another important finding of agreement, comfort and bonding, in comparison with the classical VE.

Author Contributions

We declare that all the authors have made substantial contributions to all the aspects of the manuscript. We summarized the specific contributions of each author just below: A.M. conception and design of the study, final approval of the version to be submitted; A.M. drafting the article or revising it critically for important intellectual content; I.R. –MG contributed to the designed implementation of the study; M.D. drafting the article and revising it critically for important intellectual content; final approval of the version to be submitted; I.K. contributed to the statistical analysis; A.V., G.R.D.; E.C. references research and revising for intellectual content; R.A., G.T., references research and revising for intellectual content; A.V. drafted the manuscript and designed the figures. All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement

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Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

Data Availability

Not applicable here.

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