



# NIGER DELTA JOURNAL OF MEDICAL SCIENCES

ISSN: (Print) 2736 0202 | ISSN: (Online) 2756 4002 | URL: <https://www.ndjms.org>

Official Publication of  
**The Faculty of Clinical Sciences**  
**Niger Delta University**  
Wilberforce Island, Bayelsa State, Nigeria

Volume 4 Issue 2, January 2025



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**January 2025 | Vol. 4 Issue 2**

ISSN: (Online) 2756 4002

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# Niger Delta Journal Of Medical Sciences

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**EDITORIAL: Insights and Advances in Medicine and Surgery**  
Prof. Chika Onyinyechi Duru; MBBS, MPH, MRCPCH(UK), FWACP, (Paed)  
Editor-in-Chief

*Niger Delta Journal of Medical Sciences. 2025;4(2)7*

It is with great pleasure that we present Volume 4, Issue 2 of the Niger Delta Journal of Medical Sciences. This edition reflects our continued commitment to advancing medical knowledge and addressing the unique healthcare challenges faced by our communities. The manuscripts featured in this issue underscore the diversity and complexity of medical science, providing valuable insights into clinical practice, medical education, and innovative case management.

In this issue, we delve into critical topics that resonate within the Niger Delta region and beyond.

1. "Maternal Complications Associated with Delivery of Babies Weighing 4500 Grams and Above" examines the intricate challenges of managing macrosomia and the associated maternal risks, emphasizing the need for proactive obstetric care to minimize complications.
2. "Item-analysis of the multiple-choice questions used in the formative assessment of introductory posting examination in Medicine and Surgery at a medical university in Southern Nigeria" evaluates the reliability and effectiveness of assessment tools in medical education. This study offers critical insights for educators aiming to enhance student learning outcomes and ensure robust formative evaluations.
3. "Abdominal Pregnancy with a Live Baby at Term: An Incidental Finding at Emergency Caesarean Section for Type II Placenta Praevia

in a Private Healthcare Facility in Ebonyi State, Nigeria: Case Report" highlights the extraordinary resilience of human physiology and the pivotal role of clinical vigilance in managing rare and complex obstetric emergencies.

4. "A Rare and Fatal Case of Ortner's Syndrome in A Nigerian Infant" is a report of a rare cardiac condition which highlights diverse clinical presentations and the need for high index of suspicion among clinicians.

These articles collectively provide a rich blend of clinical research, educational innovation, and case-based learning. We are particularly grateful to the authors for their contributions, which align with our journal's mission to disseminate high-quality research and foster excellence in medical practice and education.

We extend our appreciation to our reviewers, whose rigorous assessments have ensured the integrity and quality of this issue. Their expertise continues to uphold the standard of excellence that our readers expect.

We invite readers to engage with these works, reflect on their findings, and apply their insights to enhance patient care and medical education in the Niger Delta region and beyond.

Warm regards,

**Prof. Chika Onyinyechi Duru**  
Chief Editor  
Niger Delta Journal of Medical Sciences



# Maternal Complications Associated with Delivery of Babies Weighing 4500 Grams and Above

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### How to cite this article:

Ikobho E. H, Addah A.: **Maternal Complications Associated with Delivery of Babies Weighing 4500 Grams and Above** NDJMS 2024; 4(2): 8-18

Received: 8th November, 2024 | Accepted: 21st December, 2024 | Published 28th January, 2025

## ABSTRACT

**Background:** Fetal macrosomia is delivery of a baby with birth weight of 4000g and above. It is a high risk pregnancy, and it is associated with maternal and fetal complications, especially during delivery.

**Objectives:** To determine whether delivery of macrosomic babies weighing  $\geq 4.5\text{kg}$  results in more maternal complications than babies weighing  $< 4.5\text{kg}$ . It would also determine the socio-demographic characteristics of the women.

**Method and materials:** This was an analytic retrospective cross-sectional study of 200 women who delivered macrosomic babies during the study period; 46 babies weighed  $\geq 4.5\text{kg}$ , while 154 (macrosomic) babies who weighed  $< 4.5\text{kg}$  were used as control.

Data collected included bio-data, booking status, gestational age at delivery, and birth weight ( $\geq 4.5\text{kg}$  or  $< 4.5\text{kg}$ ). Data on maternal complications were: episiotomy incision during vaginal delivery, perineal tear (1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> degree), cervical laceration, estimated blood loss during delivery, and primary postpartum hemorrhage (PPH). Other data retrieved were the mode of delivery, such as: spontaneous vaginal delivery (SVD), caesarean section (CS), and instrumental vaginal delivery (vacuum and obstetrics forceps).

**Results:** The prevalence of fetal macrosomia was 7.0%, the mean birth weight was  $4.30 \pm 0.27$  kg, the mean maternal age was  $31.64 \pm 4.0$  years, and the mean gestational age (GA) at delivery was  $39.7 \pm 0.78$  weeks

Demographic factors that were significantly associated with birth weight  $\geq 4.5$ kg are: Ijaw tribe ( $p = 0.03$ ), tertiary level of education ( $P = 0.005$ ), unbooked status ( $p = 0.02$ ), and postdate ( $p = 0.0001$ ). Regarding genital tract trauma, the chances of receiving episiotomy incision was 8 times higher among the women who delivered babies weighing  $\geq 4.5$  grams, odds ratio =  $8.31[1.09, 63.19]$ ,  $p = 0.01$ . Also, the chances of having 2<sup>nd</sup> degree perineal tear was 5 time higher, odds ratio =  $5.17[1.00, 20.60]$ ,  $p = 0.0$ .

The rate of vacuum delivery was increased by 6 folds among women who delivered babies weighing  $\geq 4.5$ kg, odds ratio =  $6.14[0.80, 47.23]$ ,  $p = 0.03$ , and the CS rate by 2 folds, odds ratio =  $2.79[1.37, 5.68]$ ,  $p = 0.03$ . The mean blood loss was significantly higher among women delivered by caesarean section  $t = 14.9 [396.9, 517.2]$ ,  $p = 0.0001$

**Conclusion:** The maternal complications of fetal macrosomia escalate with increase in birth weight ( $\geq 4.5$ kg). Prominent among these are: genital tract trauma, use of instrumental vaginal delivery, and increase in caesarean section rate.

**KEYWORDS:** fetal macrosomia, birth weight  $\geq 4.5$ kg, maternal complications.

## INTRODUCTION

Fetal macrosomia is delivery of a baby with birth weight of 4000g and above. It is a very common pregnancy complication globally, and it is associated with maternal complications, which usually occur during delivery.<sup>1</sup> There is controversy surrounding the cutoff mark for the birth weight, as some people prefer to use birth weight  $\geq 4500$ grams.<sup>1,2</sup> However, literature search has revealed that a birth weight  $\geq 4000$  gram is more popular.

Delivery of big babies weighing 4000grams and above is a global health challenge, and various rates have been reported in many centers globally. While high rates were reported in Saudi Arabia (19.8%),<sup>3</sup> and Baghdad in Iraq (15.8%),<sup>4</sup> the rates in most centers in Nigeria tends to be lower. In Jos Plateau State it was 2.9%,<sup>5</sup> 2.1% in Sokoto,<sup>6</sup> and 4.7% in Sagamu.<sup>7</sup> Similar rates were

reported in other African countries; 2.3% in Tanzania,<sup>8</sup> and 1.9% in South Africa.<sup>9</sup> Besides poorly controlled gestational diabetes, and genetic factors, most of the risk factors for fetal macrosomia are demographic, and includes: advanced maternal age, high parity, high body mass index ( $BMI \geq 30\text{kg}/\text{m}^2$ ), and weight gain during pregnancy.<sup>10,11,12</sup>

Birth injuries are the most common maternal complications of fetal macrosomia. These include: high episiotomy rate, cervical and vaginal lacerations, moderate to severe perineal tear, with high risk of anal sphincter injury.<sup>13,14</sup> Other complications are primary postpartum hemorrhage (PPH) and anemia, with high risk of blood transfusion, increased caesarean section rate, and risk of shoulder dystocia.<sup>2,7</sup>

A study at University of Kwa Zulu-Natal, in South Africa reported a high caesarean section rate of 56.6%.<sup>9</sup> Another study at Gillingham in UK reported the odds of maternal complications as: 2.4 [2.0, 3.0] for severe postpartum hemorrhage, 2.3 [1.9, 2.8] for obstetric anal sphincter injury and 10.4 [8.6, 12.6] for shoulder dystocia.<sup>13</sup>

A study in France also reported that at birth weight  $\geq 4500$  grams, the rate of maternal complications increases, such as: increase in prolonged labour, odds ratio = 1.9 [1.1–3.4], and caesarean section rate, odds ratio = 2.2 [1.3–3.9].<sup>16</sup>

We acknowledge the fact that there are many studies on complications of fetal macrosomia globally, including Nigeria. However, this study intends to focus attention on the complications associated with delivery of babies with extreme birth weight of  $\geq 4500$  grams and above.

## OBJECTIVES

To determine whether delivery of babies weighing  $\geq 4.5\text{kg}$  results in more maternal complications of fetal macrosomia, than babies weighing  $< 4.5\text{kg}$ . It would also determine the socio-demographic characteristics of the women.

## METHODOLOGY

### Study site

This study was done at the labour ward, and labour ward theatre, department of obstetrics and gynaecology, Niger Delta University Teaching Hospital (NDUTH), Yenagoa in Nigeria.

### Study design

This was an analytic retrospective cross-sectional study of 200 women who delivered macrosomic babies during the study period, 46 of these babies weighed  $\geq 4.5\text{kg}$ , while 154 weighed  $< 4.5\text{kg}$ , and were

used as control. The study was carried out from January 2016 to December 2023.

### Inclusion and exclusion criteria

Women who delivered babies weighing 4000grams and above during the study period, those who had spontaneous vaginal delivery, women delivered by caesarean section, and those who had instrumental vaginal delivery.

### EXCLUSION CRITERIA

Women who delivered babies with normal birth weight and preterm babies were excluded.

### Data collection

Out of a total of 2840 women who delivered during the study period, 200 women were identified for delivering babies with fetal macrosomia. The case notes of these women were retrieved from the hospital records department, and relevant information was retrieved.

Socio-demographic data retrieved include: maternal age, parity, address (urban, semi-urban or rural), employment status, educational level, religion and tribe. Others were: booking status, and gestational age at delivery.

Data on maternal complications were: episiotomy incision during vaginal delivery, perineal tear (1st, 2<sup>nd</sup>, and 3<sup>rd</sup> degree), cervical laceration, estimated blood loss during delivery, and primary postpartum hemorrhage (PPH). Also retrieved was the mode of delivery; spontaneous vaginal delivery (SVD), caesarean section (CS), and instrumental vaginal delivery (vacuum and obstetrics forceps).

Fetal information retrieved was birth weight, categorized as  $\geq 4.5\text{kg}$  or  $< 4.5\text{kg}$ . Data (for each patient) was entered into a research proforma designed for this study.

### Data analysis

Data was analyzed using (IBM) SPSS software version 25, and Epi Info statistical software version 7. Results were presented in tables as rates, proportions, and mean with standard deviation. Test of significance was by odds ratio and difference in mean was compared using the

independent student's t - test. Confidence interval was set at 95%, and the p value significant at  $\leq 0.05$ .

### Ethical approval

Permit to proceed with this study was granted by the ethical committee of NDUTH, with registration number NDUTH/REC/0098/2024

## RESULTS

**Table 1: Socio-demographic characteristics of the women**

Variable	Categorized birth weight		Total	Odds ratio	Confidence interval	P value
	< 4.5kg, N = 154(77.0%)	$\geq$ 4.5kg, N = 46(23.0%)				
<b>Maternal age</b>						
$\leq$ 19 years	2(1.0%)	0(1.0%)	2(1.0%)			
20 – 24 years	12(6.0%)	0(1.0%)	12(6.0%)			
25 – 29 years	42(21.0%)	14(7.0%)	56(28.0%)			
30 – 34 years	66(33.0%)	22(11.0%)	88(44.0%)			
$\geq$ 35 years	32(16.0%)	10(5.0%)	42(21.0%)			
<b>Parity</b>						
Para 0	2(1.0%)	0(1.0%)	2(1.0%)			
Para 1	18(9.0%)	10(5.0%)	28(14.0%)			
Para 2	54(27.0%)	6(3.0%)	60(30.0%)			
Para 3	34(17.0%)	12(6.0%)	46(23.0%)			
Para 4	24(12.0%)	4(2.0%)	28(14.0%)			
$\geq$ Para 5	22(11.0%)	14(12.0%)	36((18.0%)			
<b>Religion</b>						
Christian	152(77.0%)	46(23.0%)	180(90.0%)			
Muslim	2(1.0%)	0(1.0%)	20(10.0%)			
<b>Ethnicity</b>						
Ijaw	78(39.0%)	32(16.0%)	110(55.0%)	0.44	[0.20, 0.96]	0.03*
Igbo	56(28.0%)	10(5.0%)	66(33.0%)			
Yoruba	4(2.0%)	2(1.0%)	6(3.0%)	1.22	[0.21, 6.99]	0.82
Hausa/Fulani	2(1.0%)	0(1.0%)	2(1.0%)			
Other tribes	14(7.0%)	2(1.0%)	16(13.0%)			
<b>Address</b>						
Urban	148(74.0%)	46(23.0%)	190(95.0%)	1.07	[0.21, 5.50]	0.93
Semi-urban	6(3.0%)	2(1.0%)	8(4.0%)			
Rural	0(1.0%)	2(1.0%)	2(1.0%)			
<b>Educational level</b>						
Primary Education	10(5.0%)	4(4.0%)	14(7.0%)	0.71	[0.20, 2.52]	0.59
Secondary Education	20(10.0%)	22(11.0%)	96(48.0%)			
Tertiary Education	70(35.0%)	20(10.0%)	90(45.0%)	0.26	[0.12, 0.57]	0.005*

<b><u>Patient's Employment status</u></b>						
Unemployed	90(45.0%)	32(16.0%)	122(61.0%)	0.62	[0.30, 1.25]	0.17
Employed	64(32.0%)	14(7.0%)	78(39.0%)			
<b><u>Booking Status</u></b>						
booked	130(65.0%)	32(16.0%)	162(81.0%)			
unbooked	24(12.0%)	14(7.0%)	38(19.0%)	2.37	[1.10, 5.09]	0.02*
<b><u>Gestational Age at Delivery (GA)</u></b>						
Preterm (28 - 36 weeks)	0(1.0%)	0(1.0%)	0(1.0%)			
Term (37 - 42 weeks)	146(73.0%)	14(7.0%)	184(92.0%)			
Postterm (> 42 weeks)	0(1.0%)	2(1.0%)	2(1.0%)			
Postdate (> 40 - 41 weeks)	8(4.0%)	6(3.0%)	14(7.0%)	7.82	[2.37, 25.78]	0.0001*

There were 2840 deliveries during the study period, out of these, 200 women delivered babies with fetal macrosomia, giving a rate (prevalence) of 7.0%.

The mean birth weight was  $4.28 \pm 0.29$ kg, the minimum was 4.0kg and the maximum was 5.5kg. The mean maternal age was  $30.98 \pm 4.4$  years, the median parity was para 3, and the mean GA at delivery was  $39.5 \pm 0.98$  weeks

Majority of the patients were Ijaw tribe; Yenagoa where this study was done is located in the heart of Ijaw tribe. However, significantly more babies weighing  $\geq 4.5$ kg were delivered by Ijaw women,  $p = 0.03$ . Other significant factors are tertiary level of education ( $P = 0.005$ ), unbooked status ( $p = 0.02$ ), and postdate ( $p = 0.0001$ ).

There was no significant association with the patient's address (urban or rural), and employment status,  $P = 0.93$ , and  $0.17$  respectively.

Table 2: Maternal complications, and the effects of increase in birth weight

Variable	Categorized birth weight		Total	Odds ratio	Confidence interval	P value
	< 4.5kg, N = 154(77.0%)	≥ 4.5kg, N = 46(23.0%)				
<b>Episiotomy</b>						
Episiotomy	24(12.0%)	1(0.5%)	25 (12.5%)			
No episiotomy	130(65%)	45(22.5%)	175(87.5%)	8.31	[1.09, 63.19]	0.01*
<b>Perineal tear</b>						
No perineal tear	124(62.0%)	40(20.0%)	164(82.0%)			
Perineal tear present	31(15.5%)	6(3.0%)	37(18.5%)	0.60	[.23, 1.54]	0.28
<b>Type of perineal tear</b>						
1 <sup>st</sup> degree perineal tear	21(10.5%)	2(1.0%)	22(11.0%)	0.30	[0.01, 1.31]	0.09
2 <sup>nd</sup> degree perineal tear	4(2%)	4(2%)	8(4.0%)	5.17	[1.00, 20.60]	0.03*
3 <sup>rd</sup> degree perineal tear	6(3%)	0(0.0%)	6(3.0%)			
<b>Cervical laceration</b>						
No laceration	146(73%)	45(22.0%)	191(95.5%)			
Laceration present	8(4.0%)	1(0.5%)	9(4.5%)	0.41	[0.05, 3.33]	0.38
<b>Mode of delivery</b>						
Spontaneous vaginal delivery (SVD)	86(42.0%)	14(7.0%)	100(59.0%)			
Caesarean section	66(33.0%)	30(15.0%)	96(48.0%)	2.79	[1.37, 5.68]	0.003*
Vacuum extraction	2(1.0%)	2(1.0%)	4(2.0%)	6.14	[0.80, 47.23]	0.05*
<b>PPH for CS</b>						
PPH present	10(5.0%)	2(1.0%)	12(6.0%)	0.38	[0.07, 2.17]	0.26
No PPH	78(39.0%)	6(3.0%)	82(94%)			
Total	88(44.0%)	8(4.0%)	96(48.0%)			
<b>PPH for SVD</b>						
PPH present	6(3.0%)	2(21.0%)	8(4.0%)	0.45	[0.08, 2.49]	0.34
No PPH	80(40.0%)	12(6.0%)	92(46.0%)			
Total	86(43.0%)	14(7.0%)	100(50.0%)			
<b>Blood transfusion</b>						
No blood transfused	136(68.0%)	42(20.5%)	178(87.0%)	0.72	[0.23, 2.24]	0.56
blood transfused	18(9.0%)	4(2.0%)	10(5.0%)			
Total	154(77.0%)	46(23, 0%)	200(100.0%)			
<b>Mean blood loss</b>						
	434.3 ± 322.4	501 ± 263.7		t = 1.29	[-35.72,169.73]	P = 0.19
<b>Mode of delivery</b>						
Mean blood loss (in mls)	SVD	CS				
	232.4 ± 202.3	689.5 ± 224.3	t = 14.9	Mean difference = 457.1	[396.9, 517.2]	0.0001*

The chances of not receiving episiotomy incision was 8 times higher among the women who delivered babies weighing less than 4.5 grams, odds ratio = 8.31[1.09, 63.19], p = 0.01.

Regarding maternal complications, delivery of babies with birth weight ≥ 4.5kg was significantly associated with 5 times chances of having 2<sup>nd</sup> degree perineal tear, odds ratio = 5.17[1.00, 20.60], p = 0.03.

The chances of delivery by caesarean section was increased by two folds, odds ratio = 2.79[1.37, 5.68],  $p = 0.03$ , and the rate of instrumental vaginal delivery (vacuum extraction) was increased by 6 fold, odds ratio = 6.14[0.80, 47.23],  $p = 0.03$ .

Regarding the mode of delivery, the mean blood loss was significantly higher among women delivered by caesarean section  $t = 14.9$  [396.9, 517.2],  $p = 0.0001$ .

However, there was no significant increase in the following rates: the mean blood loss between the 2 groups ( $P = 0.19$ ), the rate of PPH for SVD ( $p = 0.34$ ), rate of PPH for CS ( $P = 0.26$ ), and blood transfusion ( $p = 0.56$ ).

## DISCUSSION

Fetal macrosomia is delivery of a baby with birth weight of 4000g and above. It is a high risk pregnancy, and it is associated with maternal and fetal complications, especially during delivery. Though maternal mortality attributed to this condition is rare, some of the complications could cause severe, and life threatening hemorrhage if not promptly managed.

Though our rate of 7.0% is relatively low, it is comparable to results from other centers in Nigeria; 6.9% in Lagos,<sup>15</sup> 8.1% at University of Nigeria Teaching Hospital, Enugu,<sup>17</sup> and 8.9% in Port Harcourt.<sup>18</sup> However, higher rates have been reported from studies outside Nigeria; 19.8% in Saudi Arabia, [3] 12.7% in the UK,<sup>13</sup> and Baghdad in Iraq (15.8%).<sup>4</sup>

The difference may emanate from good living standards, and better nutrition; studies have proven that good maternal nutrition increases birth weight.<sup>19,20</sup> The use of gross domestic product (GDP) per capita has provided an objective measure of the living standards of a country. Nigeria is rated as one of the poorest countries in the world, with a GDP per capita of only \$ 2,162. In contrast, that for Saudi Arabia is \$30,447.9, for UK it is \$46, 125.3, and the highest is USA (\$74, 161.0).<sup>21</sup>

Regarding the association between birth weight  $\geq 4500$ grams and complications of fetal macrosomia, literature search

indicates that articles on this subject matter are scanty. Secondly there is dearth of publications comparing the complications rates of birth weight  $\geq 4500$  grams and those  $< 4500$  grams (as we did in this study).

A prominent and very common complication of fetal macrosomia is genital tract trauma, which could be: episiotomy, perineal tear, cervical and vaginal lacerations. The intent of episiotomy is to widen the vaginal outlet, and prevent perineal tear during delivery. Evidence from a meta-analysis in Ethiopia has proven that episiotomy is 6 times more likely to be given when the birth weight is  $> 4000$  grams, odds ratio = 6.71(3.14–14.33).<sup>22</sup> This did not vary widely with the odds of 8.33 we got from our study. Similar results were obtained in Brazil where birth weight  $> 4000$  grams was identified as a leading cause of episiotomy,<sup>23</sup> and in Yenagoa, where a high rate episiotomy (31.8%) was reported among babies weighing  $> 4000$ grams.<sup>24</sup>

Perineal tear is quite common during delivery of macrosomic babies, and experience from obstetrics practice in Nigeria indicates that the extent of tear is directly proportional to the size of the baby; hence it's rare in low birth weight babies (1500 – 2500 grams), and unknown in very low birth weight ( $< 1500$ grams). However the dynamics changes exponentially with big babies.

A study in Sweden reported that birth weight of  $\geq 4500$  grams was significantly associated with perineal tear.<sup>25</sup> A study at Democratic Republic of the Congo identified birth weight  $> 4000$  grams as the cause of perineal tear in 42.9% of the cases.<sup>26</sup> However, this is much higher than the 18.5% rate we got in this study. This is most probably due to the fact that our denominator was total birth (including CS), but not limited to only vaginal delivery.

Regarding the degree of perineal tear, our results indicates that majority of our perineal tears were mild (1<sup>st</sup> and 2<sup>nd</sup> degree), and only 3.0% were severe (3<sup>rd</sup> degree). There was no case of 4<sup>th</sup> degree perineal tear. This is most probable due to our high episiotomy rate, which is protective against perineal tear. A previous study at NDUTH reported a high episiotomy rate of 45.5%<sup>27</sup> However, among women with genital tract trauma in NDUTH; the episiotomy rate was higher (63.7%); it was the commonest genital tract trauma in NDUTH.<sup>28</sup>

We also observed from our study that 1<sup>st</sup> degree perineal tear was the most common type in NDUTH, and the trend tends to replicate in other centers in Africa. In Democratic Republic of Congo, 1<sup>st</sup> degree tear was reported as the commonest, with a rate of 64.3%.<sup>29</sup> In Calabar, Nigeria, it was the most common perineal tear, accounting for 40.2% of the cases.<sup>30</sup>

Regarding birth weight  $\geq 4500$  grams, though a great majority of the studies did not use it as their denominators (as stated above), the fact has been established by many studies that delivery of babies with birth weight  $> 4000$  grams is highly associated with genital trauma.<sup>8,31</sup> A cohort study also reported that the rate of major degree perineal tear (3<sup>rd</sup> and 4<sup>th</sup> degree) was

significantly higher when birth weight was  $> 4000$ grams, (odds ratio = 1.7).<sup>31</sup>

This has been vindicated by our study; delivery of  $\geq 4.5$ kg babies was significantly associated with a 5 fold rise in the rate of 2<sup>nd</sup> degree perineal tear, odds ratio = 5.17,  $p = 0.03$ . This is due to the fact that during vaginal delivery, the large fetal head of macrosomic babies over stretches the perineum, and if precautions are not taken, perineal tear could occur easily. A prophylactic episiotomy is hereby advocated for vaginal delivery of fetuses with estimated fetal weight  $\geq 4500$  grams (on obstetrics ultrasound scan).

With respect to the mode of delivery, we were able to establish the fact that delivery of birth weight  $\geq 4.5$ kg significantly increases the rate of caesarean section and vacuum delivery, with odds of 2.79 and 6.14 respectively. This is because the large size of the fetal head poses a disproportionate diameter that could not easily navigate through the axis of the maternal pelvis during labour. This could cause prolonged labour, cephalopelvic disproportion, deep transverse arrest and obstructed labour. Most of these complications could only be overcome by assistance, to complete the delivery process.

Similar results on the extent to which fetal macrosomia modify the mode of delivery has been published in many articles globally. Results from a study in Enugu indicates that the caesarean section, and instrumental vaginal delivery rates were significantly higher in women who delivered macrosomic babies,  $p = 0.001$  respectively.<sup>17</sup> Another study in the UK reported that the chances of having a caesarean delivery was 3 times higher, odds ratio = 3.1(2.6 - 3.60).<sup>13</sup> A similar result



was obtained in Ottawa in Canada, odd ratio = 1.45.<sup>32</sup>

### Conclusion

The maternal complications of fetal macrosomia escalate with increase in birth weight ( $\geq 4.5\text{kg}$ ). Prominent among these are: genital tract trauma, use of instrumental vaginal delivery, and increase in caesarean section rate.

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## A Rare and Fatal Case of Ortner's Syndrome in A Nigerian Infant

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How to cite this article:

Umeoguaju C. C, Olorukooba A. A, Musa A., Nazir H. U.: **A Rare and Fatal Case of Ortner's Syndrome in A Nigerian Infant** NDJMS 2024; 4(2): 19-22

Received 17th November, 2024 | Accepted 10th December, 2024 | Published 28th January, 2025

### Abstract

*Ortner's Syndrome, also known as cardio-vocal syndrome, is a rare condition characterized by hoarseness of voice resulting from compression or irritation of the recurrent laryngeal nerve due to cardiovascular anomalies, typically left atrial enlargement. This case report presents a Nigerian infant diagnosed with Ortner's Syndrome secondary to cleft mitral valve with severe mitral valve regurgitation and left sided infective endocarditis, emphasizing the clinical features, diagnostic workup, and management in a low- and middle-income countries*

### Introduction

**O**rtner's Syndrome is an uncommon syndrome first described by Norbert Ortner in 1897. It occurs due to the compression of the recurrent laryngeal nerve, often because of cardiac conditions<sup>1</sup>. The condition is particularly rare in infants without previous cardiac surgery or significant respiratory issues. This report aims to highlight the presentation and management of Ortner's Syndrome in a Nigerian infant.

### Case presentation

A 7-month-old female infant was referred to our Paediatric unit with a 6-weeks history of progressive difficulty in breathing, 4-weeks

history of significant weight loss and a 1-day history of fever and hoarseness of the voice. There was a history of body swelling which resolved prior to presentation. Prior to this illness, patient was said to be growing well and in good health. However, she was noted to have lost 1.6kg within 1 months. She was treated for pneumonia in a tertiary hospital and commenced on frusemide and spironolactone following suspicion of congenital heart disease. The child was the product of a full-term pregnancy delivered via normal vaginal delivery, with no significant prenatal history.

On physical examination, she was found to have hoarse voice, in severe respiratory

distress, cyanosed with oxygen saturation of 65% in room air, which rose to >95% in low flow nasal cannula oxygen, tachypnoeic, with markedly reduced air entry in the left hemithorax and widespread fine crepitations on the right lung zones. Cardiovascular examination showed normal pulse volume and synchronicity, precordial bulge and precordial hyperactivity with a displaced apex beat, 6<sup>th</sup> intercostal space, anterior axillary line. Heart sounds showed S1, S2 and S3 summation gallop rhythm with a loud P2 and apical systolic murmur radiating to the left axilla. There was also tender hepatomegaly measuring 6cm below the right costal margin, mid-clavicular line. Blood work up showed evidence of bacteria infection. Chest x-ray showed cardiomegaly with a cardiothoracic ratio of 0.8, collapse of the left lower lung lobe and increased pulmonary vascular markings in the right lung. Echocardiography showed severe AV valve regurgitation with severe pulmonary hypertension and enlarged pulmonary artery, cleft anterior leaflet of the mitral valve, features of infective endocarditis and bi-atrial enlargement with LA/Ao ratio of 2.1. ECG showed rightward axis deviation and sinus tachycardia. Nasopharyngeal aspirate was positive for respiratory syncytial virus. She had a lung ultrasound which was suggestive of severe pulmonary oedema involving the right lung.

Patient was promptly transferred to ICU and managed with nasal CPAP and antibiotics and diuretics. Initial improvements were noticed after 72 hours on CPAP, and she was weaned off non-invasive ventilation after the lungs re-expanded and work of breathing resolved. Her voice was also noticed to have improved. She however had another period of desaturation and succumbed thereafter.

## Discussion

Ortner's Syndrome is typically caused by anatomical or functional cardiac abnormalities<sup>2</sup>. In this case, a cleft mitral valve with left-sided infective endocarditis was identified as the underlying cause of left atrial enlargement,

which subsequently led to severe mitral regurgitation and compression of the recurrent laryngeal nerve. In addition to left atrial enlargement in this patient, there was severe pulmonary artery dilation which resulted from pulmonary hypertension, and this can also cause compression of the left recurrent laryngeal nerve as it was reported in a study by Zaki SA *et al*<sup>3</sup>. This nerve compression can result in hoarseness as found in this patient. There was also left lower lobe of the lung collapse resulting compression of the left main bronchus by the dilated pulmonary artery. This finding is possible in infant because of the compliant airways. Pulmonary artery induced airway compression in infant has also been documented in a study by Park *et al*<sup>4</sup>.

The initial hypothesis proposed by Norbert Ortner suggested that an enlarged left atrium compresses the nerve positioned under the aortic arch, leading to nerve palsy<sup>5</sup>. While several explanations for this syndrome exist, nerve compression between the aorta and pulmonary artery is a consistent observation<sup>3,6</sup>. The left recurrent laryngeal nerve is often affected due to its elongated route around the aortic arch<sup>2</sup>. Zaki *et al*<sup>7</sup> reported 2 cases of Ortner's syndrome in infants with congenital heart disease which resolved following corrective surgery.

Peak incidence is observed in older adults, but it can be found across all age demographics, including infants<sup>8</sup>. Ortner's Syndrome accounts for one to three percent of cases of extralaryngeal hoarseness<sup>8</sup>. Although various cardiopulmonary disorders have been linked to this syndrome<sup>9</sup>, there have been no documented associations with infective endocarditis, pulmonary oedema, or lung collapse, as seen in our case.

Despite the absence of a laryngoscopy for direct examination in this case, the improvement in vocal function following the management of pulmonary oedema supports our theory. This condition is frequently underrecognized and can be misdiagnosed as laryngitis. Notably, while congenital heart disorders are common

in Nigeria, Ortner's syndrome itself remains a rarity, underscoring the necessity for thorough evaluations in paediatric patients presenting with unusual vocal symptoms.

### Conclusion

Ortner's Syndrome is a rare but significant condition in infants that can present with hoarseness. Early recognition and appropriate management of the underlying cardiac anomaly can improve outcomes. This case emphasizes the need for heightened awareness of Ortner's Syndrome among healthcare providers, particularly in regions with limited access to advanced diagnostic tools. Further research into the prevalence and outcomes of such cases in Nigerian infants is warranted to enhance understanding and management strategies.

**Keywords:** Ortner's Syndrome, infant, hoarseness, recurrent laryngeal nerve, Nigerian, mitral regurgitation, infective endocarditis, severe pulmonary hypertension.

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Figure 1: chest x-ray shows left lower lung collapse, cardiomegaly and increased vascular markings on the right lung.

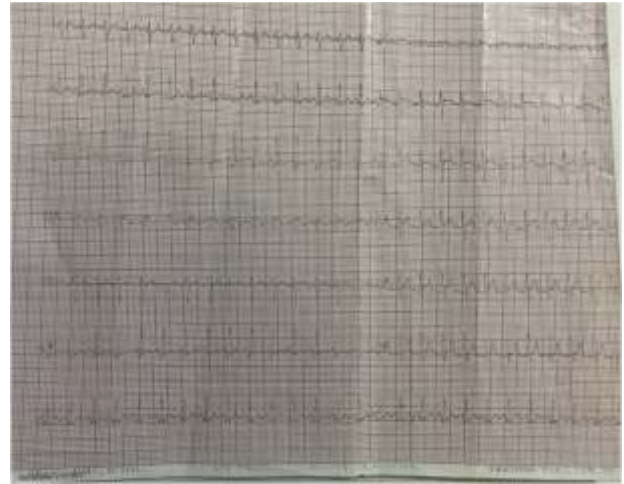


Figure 2: ECG shows right axis deviation, bi-atrial enlargement left ventricular hypertrophy and sinus tachycardia

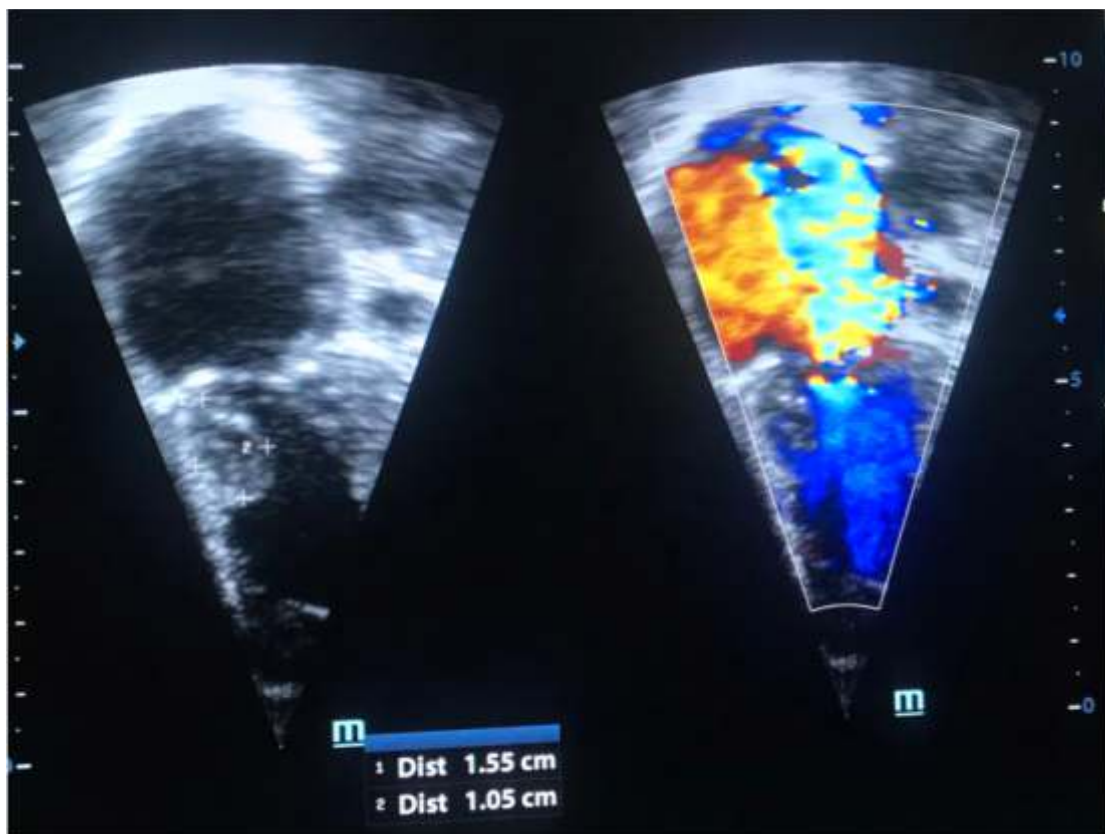


Figure 3: The left panel shows a vegetation below the anterior mitral valve leaflet, while the right panel shows severe mitral regurgitation

# Abdominal Pregnancy with a live baby at term: An incidental finding at Emergency Caesarean section for type ii Placenta Praevia in a Private Healthcare Facility in Ebonyi state, Nigeria: Case Report

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## How to cite this article:

Ugoji D-P. C, Ortuanya K. E, Uwakwe E. C, Udu U.C, Idika I. M, Antia G. A, Samuel H. D, Agwu U. M, Enyinna P. K.: **Abdominal Pregnancy with A Live Baby at Term: An Incidental Finding at Emergency Caesarean Section for Type ii Placenta Praevia in A Private Healthcare Facility in Ebonyi State, Nigeria: Case Report** NDJMS 2024; 4(2): 23-31

Received 6th August, 2024 | Accepted 10th December, 2024 | Published 28th January, 2025

## Abstract

We present a case of an unbooked 33yr old G4P2+1 with abdominal pregnancy and a live baby at term. This was an incidental finding at an emergency cesarean section for type II placenta praevia in a secondary facility in Ebonyi State, Nigeria. She had a previous history of left tubal ectopic pregnancy with salpingectomy. She presented with complaints of continuous abdominal pain, ultrasound diagnosis of type II placenta praevia and a previous history of centennial bleeding. On examination, though her vital signs were unremarkable, the lie and presentation were not appreciable and the fetal heart rate was not heard. An assessment of type II placenta praevia at term was made and she was worked up for an emergency Cesarean section. Intraoperatively, a highly vascularized placenta with anastomotic branches to the peritoneum was seen. The placenta was firmly attached to the left uterine cornus but was adherent to the left broad ligament, transverse and sigmoid colon.



*A normal right fallopian tube and ovary were seen. A live healthy female fetus was extracted with a birth weight of 2.7 kg and an Apgar Score of 7<sup>1</sup>10<sup>5</sup> and with no obvious deformities. The placenta and membranes were gradually separated and haemostasis achieved. She received a total of 7 units of blood before discharge and was offered intra uterine contraceptive device at six weeks.*

**KEYWORDS:** abdominal pregnancy, life ectopic baby, term ectopic gestation

## Introduction

**A**bdominal pregnancy is a rare subset of ectopic pregnancy accounting for 1% of ectopic pregnancy and is usually defined as implantation within the peritoneal cavity.<sup>1</sup> It usually carries a grave prognosis and can account for significant morbidity and mortality especially when advanced, that is beyond 20 weeks of gestation.<sup>2</sup> It has been classified into primary and secondary.<sup>2</sup> The precise prevalence of advanced abdominal pregnancy in Nigeria is not known.<sup>3,4</sup> However, a 30-year review done in a hospital setting in South Eastern Nigeria showed an incidence of 1 in 2761 births while a ten-year review in South Western Nigeria gave an incidence of 1 in 654.<sup>3,4</sup> The reason for the wide disparity in incidence cannot be readily explained. Incidence data from other parts of Africa showed rates of 1:1320 in Ghana, 1:3259 in Tanzania, and 1:9500 in Zimbabwe.<sup>5-7</sup>

There is a wide clinical spectrum of presentation that makes abdominal pregnancy a diagnostic dilemma, especially in low-resource settings.<sup>2,3</sup> Abdominal pain was the commonest presentation in about 85% of the patients, followed by absent fetal movement and abdominal mass (25% each).<sup>2,3</sup> There is a substantial rate of missed diagnosis of abdominal pregnancy (AP) before surgery.<sup>8</sup> A 32-year review in China showed that only 29.4% of cases were diagnosed before surgery and suggested that increased gestational age and appearance of fetal heartbeat were predictive of increased accuracy of pre-operative diagnosis.<sup>8</sup> Another study in the United States admitted that only 11.1% of cases were diagnosed before surgery.<sup>9</sup> However, two studies done in Nigeria gave a prevalence of 33.3% and 50% accurate pre-operative diagnosis, and attributed missed diagnosis to non-specificity of clinical features/

presentation.<sup>2,3</sup>

Ultrasonography remains the cheapest, safest and readily available tool for the diagnosis of abdominal pregnancy, especially in low-resource settings. Ultrasound helps in differentiating intrauterine and extrauterine pregnancies and can also differentiate primary and secondary abdominal pregnancy.<sup>10</sup> The Studdiford criteria is useful in the diagnosis of primary abdominal pregnancy and is based on three important findings viz: normal bilateral fallopian tubes and ovaries, absence of uteroplacental fistula, and a peritoneal pregnancy, which is a rare type of ectopic pregnancy where the embryo implants directly on the peritoneal surface. This condition often occurs early, potentially following a primary implantation in the fallopian tube, which later results in secondary implantation onto the peritoneum. Despite its usefulness, ultrasonographic diagnosis may still be tasking due to operator dependence, gestational age, maternal obesity, fibroid and a retroverted uterus, and false reassurance from multiple previous scans reporting intrauterine gestation.<sup>11</sup> Magnetic resonance imaging is another investigation used for the diagnosis of AP; its ability to differentiate tissues with higher accuracy makes it superior to ultrasound in fetal and placental localization.<sup>12,13</sup>

There are no specific guidelines on the management of AP.<sup>16,17</sup> However, a case-by-case review, revealed that certain approaches were adopted depending on the gestational age, time of diagnosis (i.e. preoperative or intraoperative), placental characteristics, site of implantation and region of practice (low- vs high- resource setting).<sup>16,17</sup> Three approaches are commonly employed viz: conservative, laparoscopic and laparotomy.<sup>16,17</sup> The

conservative approach whereby the fetus is followed till viability before surgical intervention is often employed with variable success.<sup>17</sup> Expectant management in one cohort showed that 72% of women with AP had live babies with 11% of neonatal death and 2 cases of stillbirth.<sup>18</sup> Anesthetic considerations for AP usually involve general anesthesia.<sup>19,20</sup> Blood must be grouped and crossmatched because of the risk of hemoperitoneum especially after placental separation; this was noted in a review of 163 cases which showed that 80% of patients required blood transfusion.<sup>21</sup>

A very important decision is the management of the placenta. Several approaches have been employed viz: umbilical artery embolization,<sup>21</sup> post-operative methotrexate injection<sup>16</sup> and conservative to radical surgical approaches,<sup>22</sup> all these depend on findings during surgery. However, with the surgical option, placental localization and separation with control of hemostasis is paramount.<sup>22</sup> Other surgeries like salpingoplasty/salpingectomy or even hysterectomy may be considered in selected cases.<sup>22</sup> Post operative management should be in the intensive care unit for the hemodynamically unstable mother. Blood transfusion and close monitoring of maternal hemodynamics as well as surveillance for sepsis must be undertaken. Other complications to look out for include paralytic ileus, postoperative hemoperitoneum, anemia, hypovolemic shock, and acute kidney injury. Newborn screening for fetal malformations must be carried out, as 40% of cases are associated with fetal malformation.<sup>22</sup> There is also a risk of maternal death.

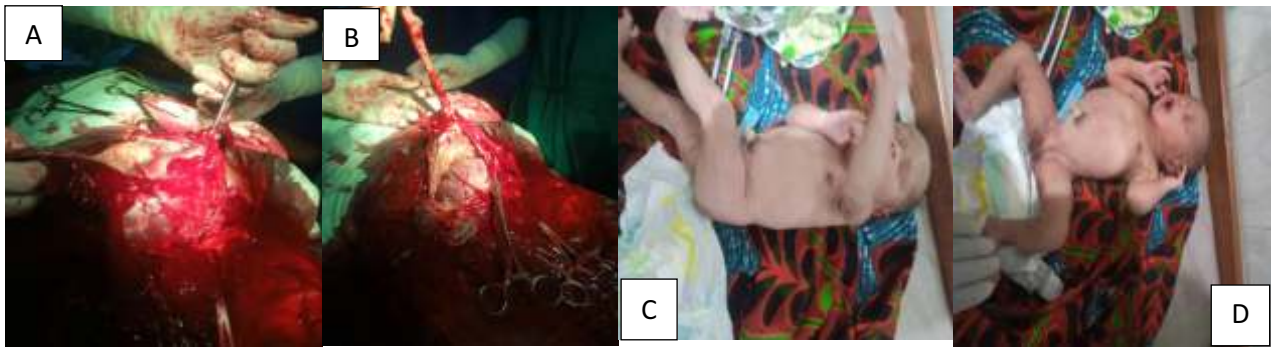
### Case presentation

This is the case of an unbooked 33yr old G4P2+1, 2 alive who was unsure of the date of her last menstrual period but had an estimated ultrasound gestational age of 39 weeks + 4 days. She had a previous history of left tubal ectopic pregnancy, for which she underwent left salpingectomy. She presented at a private

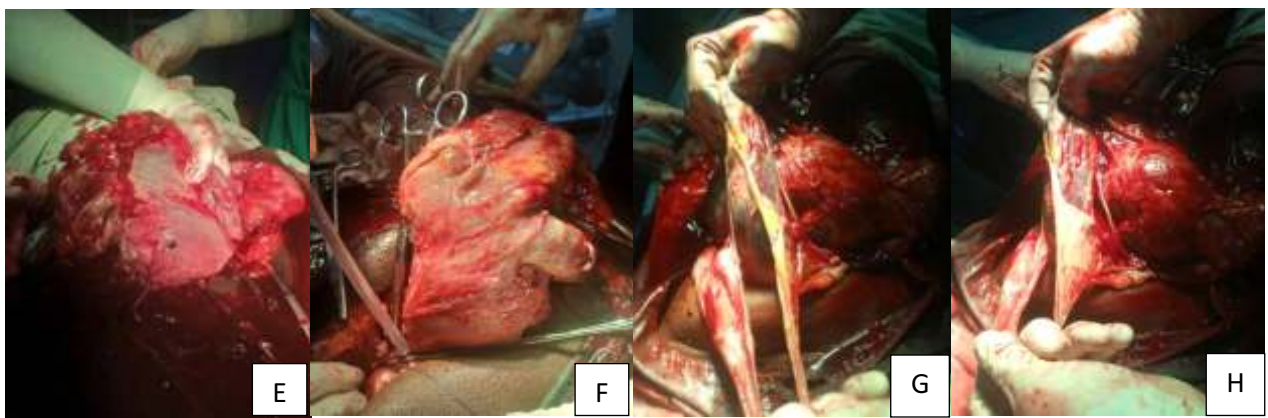
secondary healthcare facility in Ebonyi State on March 2023 with complaints of continuous abdominal pain. The pain was worse around the right lumbar and hypochondriac regions, was noted to have started 13hrs prior to presentation and was associated with urinary frequency. There was also a history of bleeding per vagina that occurred during the first trimester of the index pregnancy.

Examination findings revealed a woman that was afebrile (36.8°C), anicteric, neither pale, cyanosed, nor dehydrated with a regular pulse rate of 77 beats per minute but blood pressure of 160/90 mmHg. Abdomen examination showed a gravid uterus with a symphysio-fundal height of 33 cm. The fetal lie and presentation were not appreciable. The fetal heart rate was not heard. Emergency obstetric ultrasound done at two different facilities on the same day of presentation showed a viable fetus at 39 weeks with type II placenta praevia and associated intraplacental hemorrhage. An initial assessment of type II placenta praevia at term was made. She was subsequently worked up for an emergency lower segment caesarean section. Preoperative packed cell volume was 30%. Serum electrolytes, retroviral screening, Hepatitis B and C and urinalysis were normal. Three units of blood were grouped and crossmatched. A written consent was obtained from the woman and the husband.

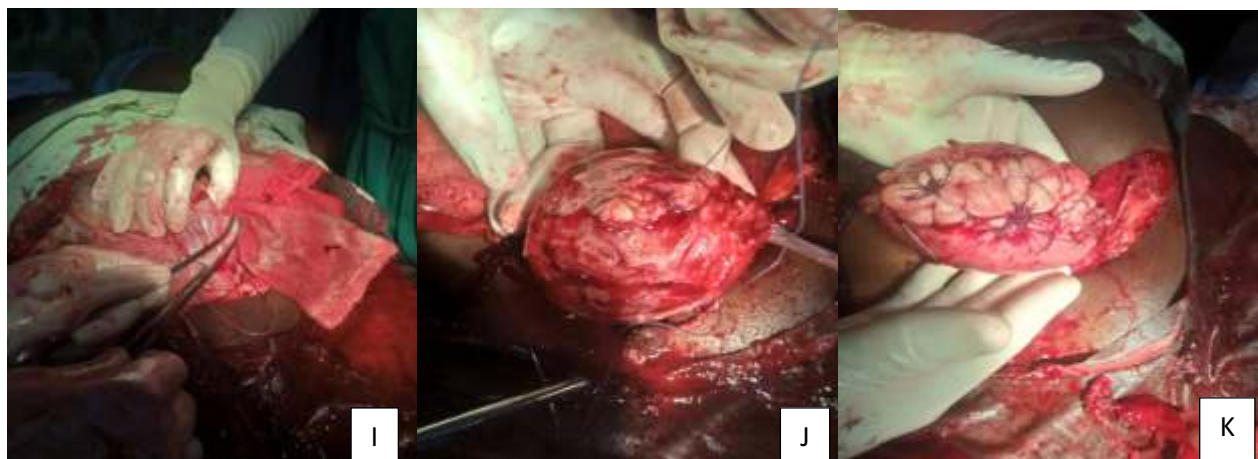
An extended Pfannenstiel incision was made with entrance into peritoneal cavity. A highly vascularized placenta with anastomotic branches to the peritoneum was seen. The placenta was firmly attached to the left uterine cornus and also adherent to the left broad ligament, transverse and sigmoid colon. A normal right fallopian tube and ovary were seen. A live female fetus was extracted with a birth weight of 2.7 kg and an Apgar score of 7<sub>1</sub>10<sub>5</sub>. The membranes were gradually separated from their attachment to the peritoneum, gut and omentum. The lower edge of the placenta at the left round ligament was double clamped, excised and ligated.



**Figure I:** Pictures A & B show the gestational sac and cord attached to the peritoneal surface and pelvic structures following delivery of the fetus. Pictures C & D show the viable and normal fetus

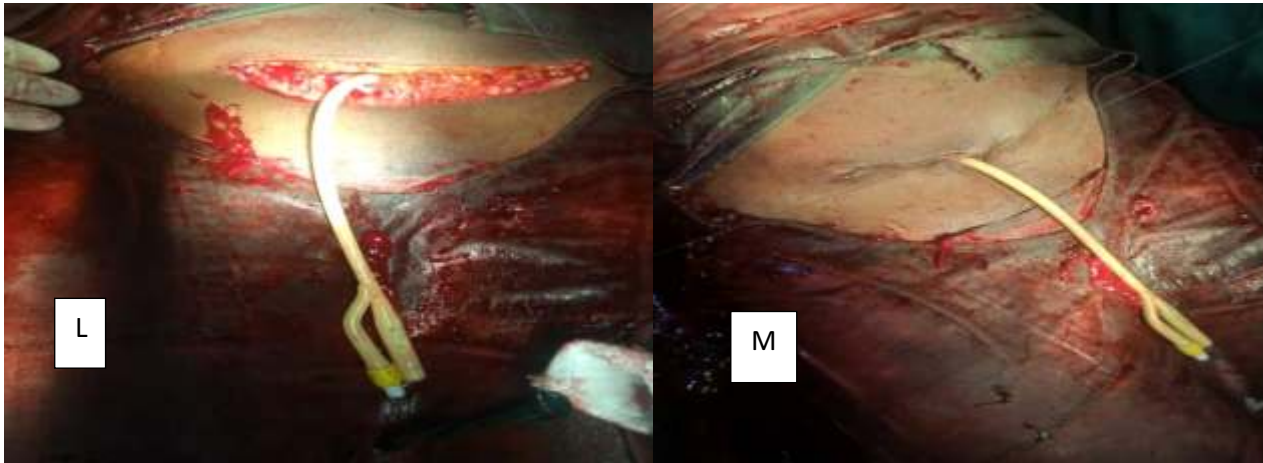


**Figure II:** Pictures E & F show the placenta bulk delivered from the abdomen with attachments. Pictures G & H show the gradual separation of the placenta from the peritoneum and pelvic structures.



**Figure III:** Picture I shows the clamping of the placenta attachment to the left broad ligament before separation. Picture J shows wedge resection of the placenta attachment to the left tubal stump. Picture K shows the metroplasty.

There was massive hemorrhage which was controlled with interrupted sutures at the area of bleed using vicryl 2. A wedge resection at the left uterine cornus and left lateral uterine wall was done and the placenta was completely separated. Metroplasty was done and hemostasis was secured using vicryl 2. An intraabdominal drain was inserted and secured. Rectus sheath and skin were sutured using vicryl 2 and vicryl 2/0 cutting respectively.



**Figure IV:** Picture L & M show the abdominal wound with catheter insertion

She received 1000 ug of misoprostol rectally and 3 units of blood were transfused intraoperatively with the fourth unit given in the immediate post-operative period. Estimated blood loss was 3 litres. Immediate post-operative blood pressure was 90/60 mmHg and pulse rate was 110 beats per minute. Post-op packed cell volume was 23% which warranted the need for further 3 units of blood transfusion. She had an in-hospital stay of 9 days with stable vital signs and was subsequently discharged home. Newborn screening did not reveal any abnormality of the baby. At six weeks she was stable and the baby was healthy. She was subsequently discharged from the clinic after receiving intrauterine contraceptive device.

## Discussion

We presented an unbooked multipara with a previous ectopic pregnancy and left salpingectomy, who was billed for emergency Cesarean section but

intraoperatively noted to have an advanced viable primary abdominal pregnancy with good feto-maternal outcome. Our case had sparing of the uterus with the fetus identified within the peritoneal cavity. Our case was primary ectopic pregnancy, as the right tube, ovary and the uterus were spared. The only attachment of the fetus to the reproductive tract was to the round ligament and left salpingectomy scar. The documented prevalence in studies showed that it is rare.<sup>3-7</sup> This is evident as this was the first seen by the team in the past 5 years in a Centre with an average cesarean section rate of 3 per day.

The wide spectrum of presentation makes it a diagnostic dilemma especially in low-resource settings.<sup>2,3</sup> There is a substantially high rate of missed diagnosis of abdominal pregnancy (AP) before surgery<sup>8</sup> and this case was one of such. A thirty-two-year review in China showed only 29.4% of cases<sup>8</sup> and in the United States only 11.1%

of cases were diagnosed before surgery.<sup>11</sup> This corroborates with two studies in Nigeria where preoperative diagnosis was made in only 33-50% of the cases.<sup>2,3</sup> This may be why a diagnosis was not made in our case preoperatively despite multiple ultrasounds done in specialized centers on the same day of the surgery. Abdominal pain was the commonest presentation in about 85% of the patients, followed by absent fetal movement and abdominal mass (25% each).<sup>2,3</sup> Abdominal pain of 13 hours was the clinical symptom necessitating the presentation of this patient. However, this missed diagnosis was attributed to non-specificity of clinical features/presentation. This was seen in the case as the clinical features were suggestive of placenta praevia while abdominal pregnancy was diagnosed intraoperatively.

Ultrasound remains the readily available tool for the diagnosis of abdominal pregnancy. However, it was not helpful in the index case as consecutive ultrasounds done did not diagnose the AP. This was the reason we presumed that this case was a case of primary abdominal pregnancy, however we missed the opportunity of an early scan to rule out the possibility of primary nidation as patient was unbooked. Diagnosis can still be challenging despite its benefits. Factors like operator skill, gestational age, maternal obesity, fibroids, a retroverted uterus, and misleading reassurance from multiple prior scans reporting intrauterine pregnancy can complicate the process<sup>11</sup>. These may be some of the reasons for the missed diagnosis in the index case.

Case-by-case review shows that there is no clear-cut guideline in the management of AP.<sup>16,17</sup> Three approaches are commonly employed viz conservative, laparoscopic and laparotomy.<sup>16,17</sup> The conservative approach whereby the fetus is followed till

viability before surgical intervention is often employed with variable success.<sup>17</sup> However, ours was an incidental finding and the only option left was laparotomy. This was employed in the index case and was successful. Our patient was unbooked and the pregnancy was carried to term with good fetomaternal outcome, even at the 6<sup>th</sup> week post-natal visit. Expectant management in one cohort showed that 72% of women with AP had live babies with 11% of neonatal death and 2 cases of stillbirth.<sup>18</sup> The possibility that the fetus in our study grew to term may be that there was good blood supply as the placenta was adherent to the blood vessels of the broad ligament. This high rate of fetal survival may explain why our patient had a live baby irrespective of her booking status. Anesthetic considerations for AP usually involve general anesthesia,<sup>19,20</sup> which was also used general anesthesia in this case. Blood transfusion is almost always required because of the risk of hemoperitoneum especially after placental separation. A review of 163 cases showed that 80% of patients required blood transfusion.<sup>21</sup> Our patient received three units of blood intraoperatively, one unit in the immediate postoperative period and three units in the ward before discharge making it a total of seven units.

In the management of the placenta, our patient was managed with a near-radical surgical approach as she had wedge resection and metroplasty.<sup>22</sup> This option was the only option left as the finding was incidental, the baby alive and need to save the baby and the mother paramount. She was managed in the ward as she was fairly stable postoperatively. There were no postoperative complications and newborn screening for fetal malformations showed normal findings.

## Conclusion

This case report shows the difficulty of advanced primary abdominal pregnancy, which remains a diagnostic and management challenge, particularly in low-resource settings. It emphasizes the importance of sensitive clinical examination, thorough preoperative evaluation, and prompt multidisciplinary care in ensuring positive outcomes in such rare conditions. The successful management of this patient exemplifies how challenges associated with advanced abdominal pregnancy can be overcome with meticulous care and teamwork.

## Limitations

1. The patient's lack of antenatal care limited the opportunity for early detection and intervention, which could have provided clearer diagnostic insights.
2. As a low-resource setting, advanced diagnostic modalities like MRI, which could have improved diagnostic accuracy, were not utilized.
3. Despite multiple ultrasounds at specialized centers, abdominal pregnancy was not diagnosed preoperatively due to the non-specific presentation and limitations of ultrasonography such as operator dependence.
4. The conclusions drawn are limited to this single case, and generalizations may not apply to all instances of advanced abdominal pregnancy.
5. Early pregnancy histological data, which could definitively establish the primary nature of the abdominal

pregnancy, was not available due to delayed diagnosis.

## Declaration of patient consent

Informed consent was obtained from the patient for the publication of this case report with the accompanying images.

The authors certify that they have obtained all appropriate consent from the patient. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patient understands that their names and initials will not be published and due efforts have been made to conceal their identity.

## Financial support and sponsorship

Nil

## Conflicts of interest

There are no conflicts of interest.

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# Item-analysis of the multiple-choice questions used in the formative assessment of introductory posting examination in Medicine and Surgery at a medical university in Southern Nigeria.

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## How to cite this article:

Harry T.C, Bozimo G.E.L, Dimoko A.A, Ikuabe P, Kombo B.B.: **Item-analysis of the multiple-choice questions used in the formative assessment of introductory posting examination in Medicine and Surgery at a medical university in Southern Nigeria.** NDJMS 2024; 4(2): 32-43

Received 23rd November, 2024

| Accepted 21st December, 2024

| Published 28th January, 2025

## **Abstract**

**Introduction:** The aim of this study was to undertake quality assurance as post-examination analysis of multiple-choice questions (MCQs) used in formative assessment.

**Materials & Methods:** Classical Test theory (CTT) and Item Response Theory (IRT) of 500 items (100 keys & 400 distractors) in single-best answer MCQs (A-type) in introductory medicine (IM)

and introductory surgery (IS) from 62 medical students was done post-examination. Anonymised answer-scripts had item responses made binary as 0 and 1 and analysed using Microsoft Excel spreadsheet & JMetrik psychometric software to determine difficulty index, discrimination index, distractor efficiency and Cronbach's alpha coefficient.

**Results:** The mean score in IM was  $60.83 \pm 9.48$  (95% C.I. 58.42 – 63.24) Fifty-four students (87.10%) [95% C.I. 76.15 – 94.26] passed and 8 (12.9%) [95% C.I. 5.74 – 23.85] failed. Thirteen (20.7%) attained a score of 70 and above.

The mean score in IS was  $63.5 \pm 7.1$  (95% C.I. 61.70 – 65.32). Sixty (96.77%) [95% C.I. 88.83 – 99.61] passed, and 2 (3.23%) [95% C.I. 0.39 – 11.17] failed. Twelve (19.3%) scored 70 and above. Difficulty index (DIF-I) of keys set at  $<0.3$  (too hard) was 10% in IM & 14% in IS. DIF-I  $>0.8$  (too easy) was 22% in IM and 40% in IS respectively.

Discrimination index (DI) of keys set  $<0.1$  (poor) was 44% in IM & 48% in IS and  $>0.3$  (good) was 10% in IM & 2% in IS respectively.

The Cronbach's alpha coefficient was 0.62 in IM & 0.45 in IS respectively.

Nonfunctioning and ineffective distractors (NFD) with a score of zero (0) was 28.8% in IM & 45.2% in IS respectively.

**Conclusion:** Item analysis in this study showed many easy questions with poor discrimination, low reliability index and poor distractor efficiency. We recommend post-examination item-analysis as part of quality assurance matrix after formative assessment.

**KEYWORDS:** item-analysis, discrimination index, difficulty index, distractor efficiency, key assignment, formative assessment.

## Introduction

The pioneer clinical class of the College of Medicine, Bayelsa Medical University, commenced their postings in introductory medicine and surgery on 23<sup>rd</sup> July 2024 in conformance to the regulatory standards of the Medical & Dental Council of Nigeria<sup>1</sup> after completing requirements of the first professional MBBS examination needed for progression as determined by the College of Medicine and ratified by Senate.

As part of the end of postings formative assessment we adopted the use of multiple-choice question (MCQs)<sup>2</sup>. Properly constructed MCQs can assess a wider

aspects of the curriculum. Designing MCQs is complicated and time consuming and can be associated with flaws<sup>3</sup>. Multiple-choice questions (MCQs) can assess higher cognitive processing like interpretation, analysis and problem-solving of Bloom's taxonomy of learning<sup>3,4</sup>, when done properly with blueprinting of the curriculum and lesson planning. The choice of MCQs could be either true/false (X-type), single best answer, also referred to as (A-type) with either 4 items (25% of getting right answer by guessing) or 5 items (20% chance of getting it correct) or extended matching questions (R-type) - have its advantages and disadvantages.

In this assessment we opted for 100 single-best answer MCQs with 5 items. Pure luck from guessing the correct answer diminishes when the questions are more than 20. The other controversial area is the scoring system<sup>7</sup>. The first is the formula scoring method, the correct answers are awarded a positive point and incorrect or omitted answers are given a negative score and the other is the number right scoring method, where incorrect and omitted answers are given no point—8 as a deterrent to guessing. We opted for the number right method in this formative assessment as this was not a high-stake exit summative assessment. We ensured that content expert in blueprinting of MCQs previewed the questions for flaws.

Formative assessment relates to how the assessments inform the students about their performance and enhances learning, underpinning Knowles Theory 9 of andragogy (adult-learning). The Knowles theory of self-directed learning helps learners develop the capacity for self-direction, self-evaluate and self-actualize.

This is a study of the analysis of the raw scores and item analysis of the responses to the multiple-choice questions in introductory medicine and surgery using psychometrics<sup>10</sup>. The aim of the study was to identify any gaps in the assessment and guide the conduct of subsequent assessments with MCQs. It will also provide objective feedback to the students and inform lecturers of unmet needs and deficiencies. One of the key goals of medical education, espoused<sup>11</sup> is to ensure that the true scores approaches the learners true score as reliably and validly as possible.

### Materials & Methods:

This was a post-examination quality assurance study evaluating the outcome of formative assessment after two weeks posting in introductory medicine and surgery respectively using Classical Test Theory (CTT) and Item Response Theory (IRT)<sup>11,12</sup>. There were 62 students who participated in the assessment. There were 50 MCQs (A-Type) in Introductory Medicine and Introductory Surgery respectively with a lead-in question and correct option(key answer) to select with four incorrect answers (distractors)<sup>13</sup>, to be completed in two hours. Conference marking was undertaken immediately after the examination. Pass mark was set at 50 and there was no negative marking. A score of 70 and above was considered as distinction.

The Departmental Board approved and published results after conduct of the examination. Unique identifiers of matriculation number were extracted from the published results with raw scores. Individual answer scripts containing the candidates chosen answers to the multiple-choice questions were extracted. The correct key items were also collected from the Examination Officer and entered. These data were collated into *Microsoft Excel spreadsheet* as 1 for the correct answer and 0 for a wrong answer and saved as comma separated values (csv) format file.

The file was then, exported to and analysed using *JMetrik psychometric statistical software*<sup>14</sup> as binary items of (0 & 1). The binary items entered *Excel spreadsheet* was used to compute distractor efficiency as described by other workers<sup>15,16</sup>.

Descriptive statistics was performed including the use of box and whisker charts and histogram to display the scores. Student-t test was used in comparing means. For all statistical analysis  $p < 0.05$  was considered significant. Where appropriate 95% confidence interval (CI) was used, including 25% and 75% interquartile range (IQR). Discrimination and difficulty index was computed from the binary-items in the csv file using the *JMetrik psychometric statistical software* using Cronbach's alpha reliability coefficient.

The difficulty index<sup>17</sup> is the proportion of learners who answered an item correctly and ranges from 0.0 to 1.0. It compares the performance of 27% high-scorers with that of 27% low-scorers. We adopted the University of Washington, Washington, USA, which classify difficulty index<sup>18</sup> as too hard when the value is less than 0.3, moderate when the range is between 0.3 – 0.8 and very easy when the value is greater than 0.8. Most authorities<sup>19</sup> recommend drop the item if it is too difficult or easy.

Item discrimination refers to the ability of an item to differentiate among students because of how well they know the material being tested. It provides an estimate of the degree to which an individual item is measuring the same thing as the rest of the items<sup>20</sup>. Items with low discrimination index<sup>21</sup> are often ambiguously worded and should be examined. Items with negative indices should be examined to determine why a negative value was obtained. We adopted the University of Washington,

Washington, USA, which classify item discrimination<sup>18</sup> as “good” if the index is above 0.30; “fair” if it is between 0.10 and 0.30; and “poor” if it is below 0.1 or negative.

Distractor efficiency analysis is the process of evaluating the performance of incorrect answers (distractors) in multiple-choice question items. It is used to assess the credibility of distractors. A distractor<sup>122</sup> can be defined as functional when it is intended to be plausible for those students with low achievement, that is negative discrimination and to be selected by at least 5% of participants.

The Cronbach's alpha coefficient a measure of internal consistency and an estimator of test reliability<sup>23</sup> and accepted values are equal to or greater than 0.7 as benchmark.

Ethical committee approval was waived as this was a quality assurance study of post-examination answers analysed anonymously and in confidence without contact with any subjects.

### **Results:**

There were 62 students who participated in the formative assessment. The raw scores for introductory medicine showed a mean score of  $60.83 \pm 9.48$  (95% C.I. 58.42 – 63.24). The median score was 60 and IQR [54 -66]. Fifty-four students (87.10%) [95% C.I. 76.15 – 94.26] passed and 8 (12.9%) [95% C.I. 5.74 – 23.85] failed. Thirteen (20.7%) attained a score of 70 and above.

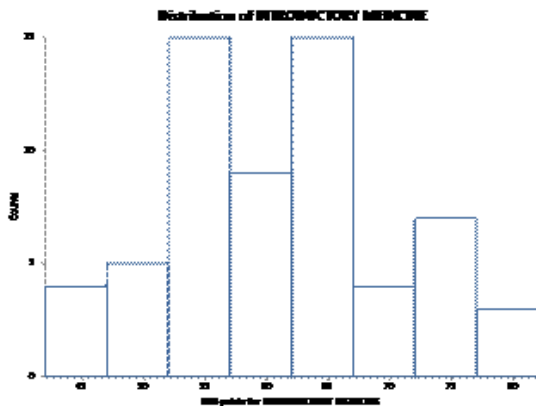


Figure 1

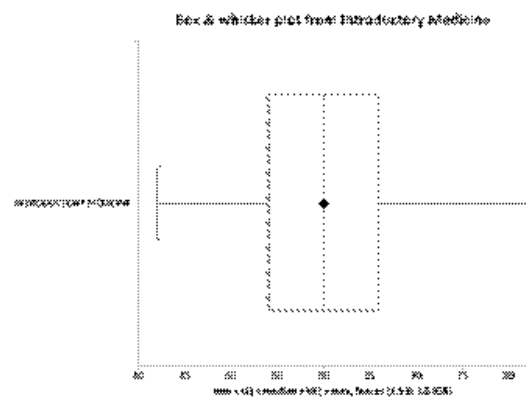


Figure 2

The raw scores of introductory surgery (see figure 3 & 4) showed a mean score of  $63.5 \pm 7.1$  (95% C.I 61.70 – 65.32) and the median score was 63, IQR [58 – 68] and range of 48 – 82. Sixty (96.77%) [95% C.I 88.83 – 99.61] passed, and 2 (3.23%) [95% C.I 0.39 – 11.17] failed. Twelve (19.3%) scored 70 and above.

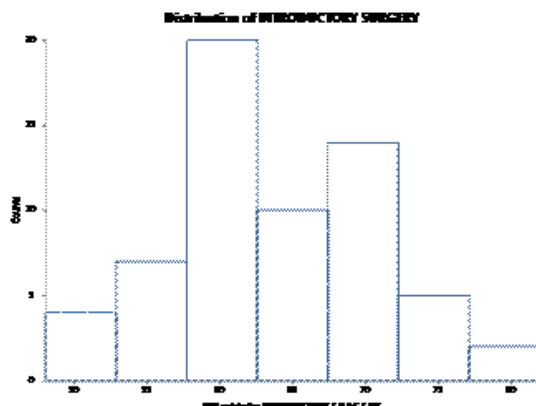


Figure 3

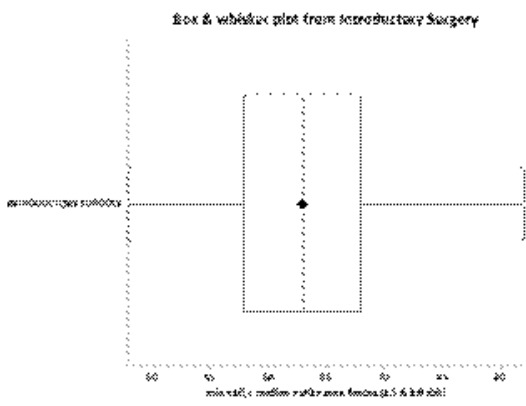


Figure 4

The mean scores in introductory medicine when compared to the mean scores in introductory surgery using the student-t test was statistically significantly different (one-sided  $p=0.02$  and two-sided  $p=0.04$ ).

Item-analysis for Introductory Medicine multiple-choice questions

In the 50 multiple-choice questions in introductory medicine with a single correct answer (key) the difficulty index of the keys is shown in table 1.

<u>Difficulty Index (DIF-I)</u>	<u>Difficulty level</u>	<u>Number of items</u>
<.3	Too hard	5 (10%)
0.3-0.8	Moderate	34 (68%)
>.8	Too easy	11 (22%)

Table 1

Items identified as difficult should be dropped from the question bank or re-examined for flaws, which could either be grammatical or poor distractor choice.

<b><u>Discrimination Index (DI)</u></b>	<b><u>Description</u></b>	<b><u>Number of items</u></b>
<0.1	Poor	22 (44%)
0.1 – 0.3	Fair	23 (46%)
>0.3	Good	5 (10%)

Table 2

Items with a key identified as poor should be discarded, while those identified as fair should be reviewed and modified. Those identified as good should be retained in the MCQ bank. All the items that scored zero should be expunged.

The Cronbach's alpha coefficient a measure of internal consistency and an estimator of test reliability<sup>23</sup> and accepted values are equal to or greater than 0.7 as benchmark. For the 50 keys analysed the Cronbach's alpha coefficient was calculated as 0.62. This is considered questionable in educational assessment where it is expected to be greater than 0.7.

#### Item analysis for Introductory Surgery multiple-choice questions:

##### **Difficulty Index (DIF-I)**

The analysis for the keys (correct answers) of 50 MCQs is as shown in table 3.

Difficulty index of the keys was set at <0.3 & > 0.8 respectively and showed 14% & 40% of the questions were either too hard or easy.

<b><u>Difficulty Index (DIF-I)</u></b>	<b><u>Difficulty level</u></b>	<b><u>Number of items</u></b>
<.3	Too hard	7 (14%)
0.3-0.8	Moderate	23(68%)
>.8	Too easy	20 (40%)

Table 3

Item keys identified as too hard will be expunged, while those identified as moderate will be retained. Items identified as too easy will be modified and if it is a high-stake summative examination that assesses true success, it should be critically reviewed.

##### **Discrimination index (DI)**

Of 50 keys in the MCQs, the correct answers showed a poor discrimination index of 48% in this examination (see table 4)

<b>Discrimination Index (DI)</b>	<b>Description</b>	<b>Number of items</b>
<0.1	Poor	24 (48%)
0.1 – 0.3	Fair	25 (50%)
>0.3	Good	1 (10%)

Table 4

Items identified as poor will be discarded and those shown to be fair will be reviewed and modified for retention. Those shown to be good will be retained.

Cronbach's alpha coefficient was reported as 0.45. This is rated as poor, as the accepted level for reliability is greater than or equal to 0.7. The seemingly good performance of a pass rate of 60 out of 62 students (97%) is from an unreliable formative assessment.

Frequency analysis of placement of keys in the answers in Introductory Medicine:

The correct answer keys A, B, C, D, E frequencies within the 50 MCQs are as shown:

<b>Value</b>	<b>Frequency</b>	<b>Relative %</b>
<b>A</b>	6	12
<b>B</b>	6	12
<b>C</b>	13	26
<b>D</b>	12	24
<b>E</b>	13	26
<b>TOTAL</b>	<b>50</b>	<b>100%</b>

Table 5

The key placement should be homogenous<sup>13</sup>, but here it is reported as heterogenous.

Item analysis of Distractor Efficiency in Introductory Medicine:

The distractor analysis of 250 items (50 keys and 200 distractors), the index of effectiveness of each item distractor is shown in table 6:

<b>Distractor effectiveness index (DE)</b>	<b>Frequency</b>	<b>Percentage</b>
Negative index	109	43.6%
Zero (0)	72	28.8%
Positive index between (0.09 – .36)	69	27.6%

Table 6

The distractors with a negative index, 43.6% is reassuring. It shows the distractors are plausible. More students in the lower group selected these than those in the higher group. Distractors with a zero index are non-functional and ineffective. The distractors with a positive index (0.09 – 0.36) are not plausible. More students in the higher group selected the distractor.

Frequency analysis of placement of keys in the answers in Introductory Surgery:

The correct answer keys A, B, C, D, E frequencies within the 50 MCQs are as shown:

Value	Frequency	Relative %
A	11	22
B	7	14
C	10	20
D	13	26
E	9	18
<b>Total</b>	<b>50</b>	<b>100%</b>

Table 7

The key placement should be homogenous<sup>13</sup>, but here it is reported as heterogenous.

Item analysis of Distractor Efficiency in Introductory Surgery

The distractor analysis was undertaken from 250 items (50keys and 200 distractors) in the introductory surgery MCQs. (see table 8)

The proportion of non-functional and ineffective distractors in the MCQs was 45.2%. This high proportion is of concern and calls for remedial action from the trainers in the construct of MCQs.

Distractor effectiveness index (DE)	Frequency	Percentage
Negative index	78	31.2%
Zero (0)	113	45.2%
Positive index between 0.09 – 0.36	59	23.6%

Table 8

The distractors with a negative index, 31.2% is reassuring. It shows the distractors are plausible. More students in the lower group selected these than those in the higher group. Distractors with a zero index are non-functional and ineffective and was reported as 45.2%. The distractors with a positive index (0.09 – 0.36) are not plausible. More students in the higher group selected the distractor.



## Discussion

Item analysis of MCQs is desirable after assessments to identify any flaws and confirm the reliability and validity. Multiple-choice questions (MCQs) can assess higher cognitive processing like interpretation, analysis and problem-solving of Bloom's taxonomy of learning<sup>3,4</sup> when done properly with blueprinting of the curriculum and lesson planning. Constructive alignment<sup>24</sup> an approach to curriculum design which is focused on closely aligning teaching and assessment to intended learning outcomes should be reflected in aligning the MCQs with learning objectives. Designing good MCQs are difficult but can be overcome when consciously done. These should be done early at the stage of lesson planning and submitted to the MCQ bank.

Nonetheless, MCQs is now a favoured assessment tool for both formative and summative assessment and in a recent study<sup>25</sup>, students show more preference to it. One of the key goals of assessment in medical education is the minimisation of all errors influencing a test to produce an observed score which approaches a learner's 'true' score, as reliably and validly as possible<sup>19</sup>. To achieve this, assessors need to be aware of the potential biases that can influence all components of the assessment cycle from question creation to the interpretation of exam scores<sup>19</sup>.

In low stake examinations as in formative assessment, it is important to undertake item analysis, which can be revealing. In the evaluation undertaken here, the high pass rate and seemingly good performance of the pioneer students is not vindicated by the item-analysis.

Firstly, the very high pass rate in

introductory surgery is flawed by the very low reliability index from the Cronbach's alpha coefficient of 0.45. The recommended reliability index from most educational assessments is a value above 0.7.

Secondly, the high proportion of easy questions in both the introductory medicine (22%) and surgery (40%) MCQs could have gone unnoticed.

Thirdly the poor discrimination index of 44% in introductory medicine and 48% in introductory surgery would have gone unnoticed.

Lastly the poor distractor efficiency of 45.2%, items scoring zero (0) in introductory surgery, seemingly accounted for the very high pass rate of 96.7% and high median score of 63%. The answer key assignment was D (26%) and A (22%) as the correct option in the items. The distractor efficiency was better in introductory medicine at 28.8%, items scoring zero (0).

A preview of all MCQs in the bank must be undertaken periodically by content experts, critically evaluating flaws in distractors. Heterogeneity of answer keys must be avoided as was the case here. Homogenous answer keys must be done consciously by the examination officer by random allocation. For example, amongst the 50 MCQs the keys A to E should be represented evenly at 20% in a 5-stem single-best answer MCQ.

This post-examination study has shown the level of difficulty in writing single-best answer MCQs and identifying factors leading to poor discrimination index as part of the teaching and learning culture, also shown by others<sup>26</sup>. The distractor efficiency of zero (0), score of 28.8% in introductory medicine and 45.2% in introductory surgery

respectively is worrying. When absolute pass scores are used and set at a fixed percentage (i.e., 50%), as they were in our centre, such a high proportion of easy items will likely result in many borderline candidates passing.<sup>27</sup>

### **Limitations:**

The limitation of this study includes not analysing in-depth poorly functioning distractors<sup>28</sup> with a relatively low choice frequency of <5%. Our post-examination analysis cannot be generalised, but the process of item analysis should be widely adopted. We used American standards to set for difficulty and discrimination indexes as there was a paucity of literature from Nigerian Medical Schools. The only study from Nigeria<sup>29</sup>, set difficulty index at (0.03 - 0.75) and discrimination index at >0.2, lower than the American standards used in this study.

There was no preview of the examination MCQs by content experts to exclude grammatical and logical cues.

### **Conclusion**

We recommend item-analysis of MCQs be undertaken routinely after formative and summative assessment in medical schools in Nigeria to ensure content validity and reliability as part of quality assurance matrix. Content experts must preview MCQ bank items to ensure consistency and appropriateness.

### **Declarations of conflict of interest**

There was no declaration of conflicts of interest from any of the authors.

**Acknowledgement**We are grateful for the

critique of the draft manuscript by Prof Ibi Erekosima, Consultant Renal Physician, Salford Royal NHS Foundation Trust, Salford, M6 8HD, England and Visiting Professor of Medicine & Medical Education, University of Port-Harcourt, Port Harcourt, Rivers State, Nigeria

### **Funding:**

No funding was obtained for this study.

### **Contributions of the authors:**

GB, PI, AD, BK, TCH all contributed to the conceptualisation of the study and participated in the draft of the manuscript. TCH did the data entry and analysis.

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