








Iatrogenic Female Genitourinary Fistula in Uganda: Etiology, Twelve-Year Trends, and Risk Factors for Development Following Cesarean Section

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Purpose: To describe the magnitude and trend of the iatrogenic genitourinary fistula in Uganda, and the risk factors for development following the Cesarean Section (CS).

Methods: A retrospective review of charts of women with a confirmed diagnosis of genitourinary fistula at four regional fistula repair sites in Uganda between 2010 and 2021 was conducted. A fistula was classified as iatrogenic if it was; ureteric, vesico-cervical, vesico-uterine, or vaginal vault fistula that followed an obstetric or gynecological surgery. The annual proportions for the ischemic and iatrogenic fistula over the study period were compared. A sub group analysis of women with genitourinary fistula delivered by CS was done to determine the factors associated with iatrogenic fistula. Multivariable log binomial regression was performed to determine the independent risk factors.

Results: There were 521 women who presented with genito-urinary fistula of which, 169 (32.4%) were iatrogenic. Most of the iatrogenic fistulae followed CS (71%). The proportions of iatrogenic fistulae increased from 8/52 (9.6%) in 2010 to 38/88 (43.2%) in 2020. The risk factors for iatrogenic fistula following CS were; Grand-multiparity (OR = 5.8; 95% CI: 2.1–15.4), Repeat CS (OR = 4.1; 95% CI: 1.8–9.3), CS performed by an intern doctor (OR = 4.8; 95% CI: 1.5–15.5) and CS done at a Health Centre IV (OR = 4.5; 95% CI: 1.2–16.7).

Conclusion: The magnitude of the iatrogenic genitourinary fistula in Uganda is high and most follow CS. There is an observed rising trend in iatrogenic fistula. The risk factors for iatrogenic fistula following CS are grandmultiparity, repeat CS, CS performed by intern doctors and CS performed at lower health facilities. There is a need for continuous training and supervision of lower cadre doctors involved in CS to reduce on the rising trend of iatrogenic fistula.

Keywords: genitourinary fistula, iatrogenic fistula, associated factors, Uganda

Introduction

A genitourinary fistula is an abnormal connection between the urinary and genital tracts resulting in uncontrollable leakage of urine through the vagina. It is estimated that more than 2 million women live with untreated fistula.¹ Data from Uganda show that 1 to 2% of women have symptoms of genitourinary fistula.^{2,3} More than 95% of the female genito-urinary fistulae in low and middle-income countries are of ischemic etiology, resulting from prolonged neglected obstructed labour.^{2,4,5} However, a number of fistulae are also believed to result from accidental injury to the urinary tract (iatrogenic) during obstetric and gynecological surgeries.⁶ The close proximity that the female urinary system has with the genital tract coupled with the complexity of the surgery and the limited skill of the surgeon, poses a risk of injury.^{7,8}

Genitourinary fistulae have devastating social and economic consequences on the lives of the affected women including; shame, rejection, isolation, divorce, loss of dignity, and poverty.⁹ There is a paucity of data on the magnitude

of iatrogenic genitourinary fistula in Uganda and the risk factors following common obstetric operations like CS. Therefore, this study described the magnitude, causes and trend of iatrogenic genitourinary fistula in Uganda over a twelve-year period and also determine the associated factors for the iatrogenic fistulae that follow CS.

Methods

Study Site and Study Population

This was a study among women with genitourinary fistula that presented for surgery at four regional fistula repair sites across Uganda from January 2010 to December 2021. The repair sites included; Mbarara Regional Referral Hospital (MRRH) in Southwestern Uganda, Bwindi community hospital in Southwestern Uganda, Nakaseke General hospital in Central Uganda and Lira Regional Referral Hospital (LRRH) in Northern Uganda. The surgeries were conducted during scheduled fistula camps by a team of urogynecologists with additional training in fistula surgery from Mbarara University of Science and Technology (MUST). Women learnt about the dates and venues of the fistula repair camps through radio, community and poster announcements.

Study Design

This was a retrospective chart review of all patients with a confirmed diagnosis of genitourinary fistula that presented for surgery at the four fistula repair sites during the study period. We further did a sub group analysis of women with genitourinary fistula that had CS as the antecedent surgery. In these, we compared those that had iatrogenic fistula with those with ischemic fistula to determine the risk factors for iatrogenic fistula following a cesarean section delivery.

Data Collection and Study Variables

We reviewed and included into this study all clinical records of women with a confirmed diagnosis of genitourinary fistula during the study period. We did not exclude any clinical records. A data capture tool was designed to abstract information from the patients' charts on: (1) socio-demographic and clinical characteristics including age at fistula development, area of residence, occupation, marital status at time of evaluation, duration with fistula and year when evaluation/ diagnosis was done, (2) obstetric history including parity at fistula development, mode of delivery (vaginal, caesarean section or instrumental) if the fistula followed delivery, (3) fistula characteristics including the type/ site of the fistula (urethrovaginal, vesicovaginal, vesico-uterine, vaginal vault and ureteric fistula), and fistula etiology/ classification (ischemic, iatrogenic, and congenital).

For iatrogenic fistula, additional information was collected on; the surgery that led to the fistula (caesarean section, obstetric hysterectomy, and elective hysterectomy for gynecological conditions), cadre of the surgeon that performed the causative surgery (specialist, resident, medical officer, intern doctor), and level of facility where the causative surgery was done (General hospital, Health center IV, and Referral hospital). The level of health facility was classified according to Uganda Ministry of Health system into; Referral hospitals including National and Regional (one with specialists like obstetricians), general hospitals (no specialists but surgeries are done by a medical doctor with a first degree otherwise called a medical officer), and a health center IV which is the lowest level facility in the Ugandan health system where a caesarean section can be performed by a medical officer. The cadre of surgeon that performed the antecedent surgery was classified into; intern doctor (one who has just completed medical school and undergoing one year of clinical apprenticeship), medical officer (a doctor who has completed internship), resident (a doctor undergoing specialty training in obstetrics and gynecology) and specialist (one who has graduated from residency).

The diagnosis of the genitourinary fistula was made by the surgical team through a combination of history (urine incontinence) and vaginal examination (digital and speculum) to locate the fistula after obtaining informed consent from the patient. In patients where the fistula could not be clearly visualized and located, retrograde filling of the urinary bladder with diluted methyl blue was performed to confirm the presence of a fistula. In patients where a ureteric fistula was suspected (a negative methylene blue test with visible urine collection in the vagina), a 3 swab-test was performed. If after 30 minutes the swabs were soaked with urine but without any blue stain, then a diagnosis of ureteric fistula was made since the standard evaluation procedures for ureteric fistula like intravenous pyelogram, cystoscopy, and CT

pyelogram are not readily available our setting. The final location and classification of the fistula were done when the patient was completely relaxed at surgery under anesthesia in lithotomy position.

The classification of a fistula into ischemic or iatrogenic was based on a study by Raassen et al.⁶ A fistula was classified as iatrogenic if a patient had any of the following fistulae after an obstetric or gynecological surgery; ureteric, vesico-cervical, vesico-uterine or vaginal vault fistula. Vesico-vaginal and urethro-vaginal fistula with or without prior pelvic surgery were classified as ischemic.⁶ Congenital fistulae were considered if the participant had any of these fistulae since birth.

The data capture tool was filled by trained research assistants (nurses and surgeons).

Data Management and Analysis

Data were manually extracted from the data collection tool into Microsoft excel version 2007 by two data entrants who are midwives and were trained prior on data collection and research procedures. Data were then exported to STATA version 15 (*StataCorp*, College Station, Texas, USA) for analysis. Categorical data were presented as frequencies and proportions. The annual proportion of iatrogenic and obstetric fistula were plotted on a line graph, and the trends over the study period were compared using a Chi squared test.

A sub group analysis of women with genitourinary fistula that had CS as the antecedent surgery was done. To determine the risk factors for the development of iatrogenic genitourinary fistula following CS, multivariable analysis were performed using log binomial regression analysis. Odds ratios (ORs) and their corresponding 95% confidence intervals (CIs) were reported. A *p* value <0.05 was considered statistically significant.

Ethics Approval and Consent to Participate

This retrospective chart review study involving human participants was in accordance with the ethical standards of Mbarara University of Science and Technology (MUST) Research Ethics Committee and the Uganda National Council for Science and Technology and with the Helsinki Declaration of 1975, as revised in 2008. The Uganda National Council for Science and Technology approved this study (No. HS368ES).

Results

Participants' Sociodemographic Characteristics

Over the study period, there were 521 women diagnosed with genitourinary fistula. Women with ischemic fistula were younger and the majority were primiparas as shown in [Table 1](#).

Types of Genitourinary Fistula Among the Study Participants

The fistula types among the 521 participants are shown in [Table 2](#). Majority were urethro-vaginal (34.7%) and vesico-vaginal fistulae (31.5%).

Etiology of Genitourinary Fistulae

The fistula etiology is shown in [Table 3](#). Majority of the genitourinary fistulae (n=346, 66.4%) were of ischemic etiology. About one-third of the fistulae (n= 169, 32.4%) were iatrogenic.

Trends of Iatrogenic Fistulae from 2010 to 2021

The trends of iatrogenic and ischemic fistulae over a period of 12 years is shown in [Figure 1](#). Generally, there has been a gradual increase in the proportions of iatrogenic fistulae from 8/52 (9.6%) in 2010 to 38/88 (43.2%) in 2020 when compared to the ischemic fistula (90.4% to 75%). This was statistically significant (*P* = 0.003). A sharp rise in both iatrogenic and obstetric fistula was observed from 2019 to 2021.

Table 1 Socio-Demographic Characteristics of Participants

Characteristic	Ischemic Fistula N = 346 (%)	Iatrogenic Fistula N = 169 (%)
Mean age (\pm SD)	32.6 (13.1)	33.5(10.7)
Age Category		
<25yrs	119 (34.4%)	29(17.2%)
25–35yrs	93 (26.9%)	64 (37.9%)
>35years	134 (38.7%)	76 (45.0%)
Marital status		
Single	41 (11.8%)	15 (8.9%)
Married	188 (54.3%)	117 (69.2%)
Divorced/separated/widowed	117 (33.8%)	37 (21.9%)
Parity at fistula development		
Primiparity (1)	149 (43.1%)	25 (14.8%)
Multipara (2–4)	126 (36.4%)	71 (42.0%)
Grand multipara (\geq 5)	71 (20.5%)	73 (43.2%)

Table 2 Fistulae Types Among the Study Participants

Fistula type	Frequency N = 521 (%)
Congenital	06 (1.2%)
Vesico – vaginal	164 (31.5%)
Vesico – uterine	26 (5.0%)
Vesico – cervical	72 (13.8%)
Urethro-vaginal	181 (34.7%)
Uretero-vaginal	41 (7.9%)
Vault	31 (6.0%)

Table 3 Etiology of Genitourinary Fistula

Etiology	Frequency	Percentage (%)
Ischemic Fistula	346	66.4%
Iatrogenic Fistula	169	32.4%
Congenital Fistula	6	1.2%
Total	521	100.0%

Surgeries Leading to Iatrogenic Fistulae

The surgeries that led to the iatrogenic fistulae are shown in Table 4. Majority of the iatrogenic fistulae followed the cesarean section (n=120, 71.0%) while others followed obstetric hysterectomy (n=36, 21.3%). The main indications for the cesarean section in these participants with iatrogenic fistulae were labour dystocia (n=73, 60.8%) and repeat CS (n=22, 18.3%). Majority of the obstetric hysterectomies (n=32, 88.9%) were due to ruptured uterus.

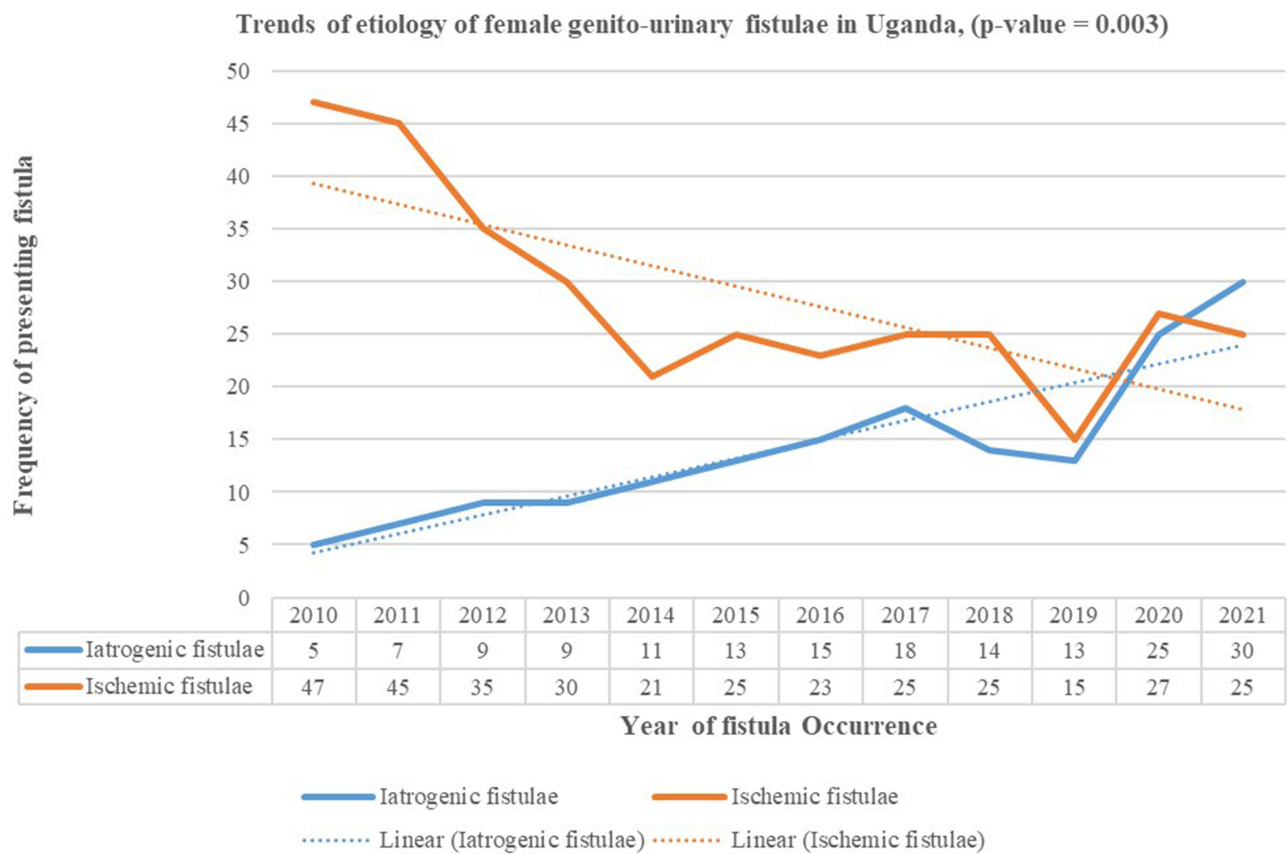


Figure 1 Trends of iatrogenic verses ischemic fistula over the 12 years.

Risk Factors for Development of Iatrogenic Fistula Following CS

We analysed 254 women with fistula that had CS as the antecedent surgery. Of these, 120 had iatrogenic fistula while 134 had ischemic fistula. In an adjusted analysis, we found that grand multiparity (aOR = 5.8; 95% CI: 2.2–15.4), repeat CS (aOR = 4.1; 95% CI: 1.8–9.3), CS performed by an intern doctor (aOR = 4.8; 95% CI: 1.5–15.5) and CS done at a Health Centre IV (aOR = 4.5; 95% CI: 1.2–16.7) were risk factors for development of iatrogenic fistula following CS as shown in Table 5.

Table 4 Types of Surgery Leading to Genitourinary Fistula

Type of Operation (n=169)	Indications	Frequency	Percentage (%)
Cesarean section (n=120, 71.0%)	Labour dystocia	73	60.8%
	Repeat CS	22	18.3%
	Transverse lie	15	12.5%
	Others	10	8.3%
Obstetric Hysterectomy (n=36, 21.3%)	Ruptured uterus	32	88.9%
	Post-partum hemorrhage	1	2.8%
	Puerperal sepsis	3	8.3%
Gynecological Hysterectomy (n=13, 7.7%)	Uterine fibroids	11	84.6%
	Pelvic organ prolapse	1	7.7%
	Cervical cancer	1	7.7%

Table 5 Risk Factors for Iatrogenic Fistula Among Women Who Had Cesarean Sections in the Antecedent Delivery

Characteristics	Iatrogenic Fistula (N=120)	Unadjusted Odds Ratios [95% C.I.]	Adjusted Odds Ratios [95% C.I.]
Age (Years)			
25–34	48 (40.0%)	Ref.	Ref.
<25	21 (17.5%)	0.3 [0.19,0.71]	0.5 [0.22,1.17]
>35	51 (42.5%)	0.9 [0.48,1.53]	0.6 [0.26,1.16]
Marital status			
Married	85 (70.8%)	Ref.	Ref.
Single	8 (6.7%)	0.4 [0.15,0.15]	1.0 [0.31,3.18]
Divorced/separated/widowed	27 (22.5%)	0.4 [0.24,0.75]	0.6 [0.29,1.07]
Parity			
Primipara (1)	17 (14.2%)	Ref.	Ref.
Multipara (2–4)	56 (46.7%)	3.0 [1.58,5.92]	1.5 [0.61,3.48]
Grand multipara (≥5)	47 (39.2%)	6.1 [2.93,12.73]	5.8 [2.18,15.40]
Type of C-section			
Primary	81 (67.5)	Ref.	Ref.
Repeat	39 (32.5)	3.6 [1.90,6.96]	4.0 [1.77,9.30]
Cadre of surgeon			
Resident	11 (9.2%)	Ref.	Ref.
Intern	15 (12.5%)	5.5 [1.92,15.46]	4.9 [1.52,15.45]
Medical Officer	94 (78.3%)	4.1 [1.99,8.56]	1.5 [0.43,5.31]
Level of health facility			
RRH	31 (25.8%)	Ref.	Ref.
General hospital	68 (56.7%)	2.6 [1.51,4.61]	3.0 [0.99,9.04]
Health center IV	21 (17.5%)	2.9 [1.33,6.46]	4.6 [1.24,16.67]

Abbreviations: 95% CI, confidence interval; C-section, cesarean section; RRH, Regional Referral Hospital.

Discussion

In this study, about one-third of all genitourinary fistulae are iatrogenic and there has been a gradual rise in the proportions of iatrogenic fistulae from 2010 to 2021. Most of the iatrogenic fistula followed obstetric surgeries mainly cesarean section. The risk factors for iatrogenic fistula following cesarean section are grandmultiparity, repeat CS, being operated by an intern doctor and CS done at a lower health facility.

The proportion of iatrogenic fistula in this study is higher than that in studies done in western Uganda and Ethiopia, which both reported prevalence of 25%.^{7,10} Another study by Raassen et al in 11 African countries also reported a lower prevalence of 13.2%.⁶ Most of the emergency obstetric surgeries, especially cesarean section in Uganda are done by medical officers,¹⁰ which explains the high proportion of iatrogenic fistula.

The trends of iatrogenic fistula has gradually increased over the 12-year period from 9.6% in 2010 to 43.2% in 2020.^{11,12} The rising trends could be due to improved access to CS but with limited skilled human resource capable of performing safe CS and variation in medical training.^{13–15} In Uganda, the cesarean delivery rate has increased from 8.5% in 2012 to 11% in 2016 (13) but this has not been matched by an increase in human resource capable of performing a safe CS due to variations in medical training.¹⁶ The sharp rise in both iatrogenic and obstetric fistulae seen from 2019 to 2021 could be due to the covid 19 induced lockdowns that restricted movement of people made it difficult to have an effective referral system leading to late referrals.^{17,18} The observed decline in ischemic fistula could be attributed to an increase in

skilled birth attendance which now stands at 91% from 74% in 2016 resulting into better labor monitoring using a partograph and as such reducing the magnitude of obstructed labor.^{2,3}

Most of the iatrogenic fistulae (71%) in this study followed CS and the majority were vesico-cervical and ureteric fistulae. This is similar to findings in previous studies done in Rwanda and Democratic Republic of Congo.^{19,20} During CS, especially for obstructed labour, there could be inferior extension of the lower segment incision into the bladder which could go unnoticed leading to a vesicocervical fistula or lateral extension into the uterine vessels resulting into injury to the ureter in an attempt to achieve hemostasis.^{6,20,21} Other factors like less skilled surgeons and adhesions from previous surgeries could explain the iatrogenic fistula.²²

In our study, grandmultiparity, repeat CS, CS performed by an intern doctor and CS done at a lower health facility (Health Centre IV) were factors associated with iatrogenic fistula from cesarean section. Our finding of high parity is in correlation with other studies where the odds of iatrogenic fistula increased with rising parity.^{14,23} This may be due to a thinner lower segment which is more likely to get tears extending to the urinary bladder during cesarean delivery (14). They are also likely to suffer pregnancy complications like a ruptured uterus and postpartum hemorrhage which may require complex surgeries like obstetric hysterectomy.⁶

Women having a repeat cesarean section are more likely to have an iatrogenic fistula. Similar findings have been reported in sub-Saharan African and Asia.^{6,14,23,24} Scar tissue and adhesions from previous cesarean delivery can create challenges for the surgeon performing the cesarean section like distortion of the pelvic anatomy and alteration of the course of the ureters leading to increased risk of injury.^{6,25}

Iatrogenic fistulae were likely to occur in CS performed by lower cadre surgeons (intern doctors). Similar findings were reported in a study by Raassen et al where iatrogenic fistulae mainly occurred in CS done by lower cadre health workers like medical officers.⁶ The lower cadres have limited skills and experience in performing difficult CS and therefore can easily make surgical errors that can result in iatrogenic fistulae. This could also be due to less supervision of the intern doctors by more senior doctors, especially in lower health facilities like general hospitals and Health center IVs.

CS done at lower health facilities, especially Health Center IVs were more likely to result into iatrogenic fistulae. In Uganda, Health Centre IVs are mainly run by medical officers who perform the cesarean sections including the complex ones like obstructed labour and previous cesarean section scars. Specialists who are more competent to handle such cases are majorly at district and regional referral hospitals. These facilities also face challenges of stockouts of sundries, inadequate lighting in the theatre and the majority have no suction machines.²⁶ This could explain the increased risk of women getting iatrogenic fistula during CS performed at Health Centre IVs.

Limitations

The study was conducted in only four out of the seven regions of Uganda and therefore results may not be generalizable to the whole country. We should have compared women that developed iatrogenic fistula following CS to women that did not get a fistula following a CS but this was not possible due to the retrospective nature of this study and also due to the fact that we only received the women after they had already developed the fistula following CS in different health facilities. We were not able to describe any regional variation in CS and iatrogenic fistula rates. Further work is needed to describe the incidence of iatrogenic fistula following CS, identify any regional variations and risk factors.

Conclusion

Iatrogenic genitourinary fistula in our setting is common, and is gradually increasing. Most of the iatrogenic fistulae follow cesarean section and the risk factors are grandmultiparity, repeat CS, CS performed by intern doctors and CS performed at lower health facilities. We therefore recommend continuous training and support supervision of intern doctors, medical officers and other lower cadre doctors involved in cesarean sections in order to reduce on the rising trend of this devastating condition. Furthermore, difficult CS like those due to severe obstructed labour and repeat CS should be done by the more experienced surgeons.

Ethical Approval and Informed Consent

The study received approval from the Ethics committee of Mbarara University of Science and Technology (reference number- 17/08-18) and Uganda National Council for Science and Technology (number HS368ES). The waiver of consent was obtained since this was a review of records. Participants' privacy and confidentiality were ensured by using codes during data entry and not the names. The charts and research materials were kept in a lockable cupboard, only accessible to authorize research team members.

Acknowledgments

The authors are sincerely grateful for the support given by the staff of fistula surgery units at the four hospitals. We are also thankful to the surgeons that helped in the management of these patients. We would like to thank our research assistants: Maurice Muhiire, Josephine Ndyanabo and Christine Mukiiza for the good work.

Author Contributions

All authors made significant contribution to the work reported, whether that was in conception, study design, implementation, data collection, analysis and interpretation, or in all these areas; took part in drafting, revising or reviewing the manuscript; approved the version to be published; have agreed on the journal to which the manuscript has been submitted; and agree to be accountable for all aspects of the work.

Funding

Else Kroner Fresenius Foundation provided funding to this study. The funders had no role in any stage of the study.

Disclosure

Dr Christopher Tarnay reports grants from Boston Scientific Corporation, outside the submitted work. The authors declare no other competing interests in this work. This paper has been uploaded to Research Square as a preprint: <https://www.researchsquare.com/article/rs-3156167/v1>.

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