



Identification of urological anomalies associated with anorectal malformation in southwestern Uganda: limitations and opportunities

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Structured summary

Introduction: Anorectal malformations (ARMs) may be associated with congenital anomalies affecting other body parts namely vertebral, anorectal, cardiac, tracheoesophageal, renal, and limb (VACTERL) with varying incidences of 7% - 60% [1-10]. Genitourinary defects might occur approximately in 50% of all patients with anorectal malformations [11] hence patients should be evaluated from birth to rule out these defects.

Objective: To identify urological anomalies associated with anorectal malformation in southwestern Uganda

Study design: This was a descriptive retrospective cohort study conducted at our regional referral hospital in Southwestern Uganda involving patients who have undergone surgical correction of ARMs between June 2021 and July 2023.

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Ethical Approval: We obtained ethical approval from the University Faculty Research Committee (FRC), Research Ethics Committee (MUST-REC) #MUST-2021-64 and Uganda National Council of Science and Technology (UNCST) #HS1632ES.

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Results: The overall prevalence of renal anomalies in our study patient population was 18.05%. Of those with ARM-associated renal anomalies, Specific anomalies included; renal agenesis (6.8%), hydronephrosis, (4.5%), duplex collecting system (3.8%), crossed fused kidney (1.5%), and ectopic kidney (0.75%). (Table)

Discussion: We found that the prevalence of ARM-associated renal anomalies was 18.05%, and the commonest anomaly was unilateral agenesis (6.8%) similar to other studies [12]. Previous data have shown renal anomalies are common anomalies in ARM[13]. While the exact values vary across studies, they all concluded that the rate of associated anomalies is extremely high in ARMs and warrants a thorough preoperative investigation once the ARMs are detected. This finding therefore underscores the importance of thorough evaluation and a multidisciplinary approach of care and follow-up system for ARM management including urologists even when the children are asymptomatic now. The main limitation of our study was missing information on patients' charts, we were not able to get the diagnosis since most patients didn't have their discharge forms at the time of evaluation.

Conclusion: ARM associated with renal anomalies may remain undiagnosed and asymptomatic. Those identified as asymptomatic need to be followed in a multidisciplinary fashion including pediatric urologists.

Introduction

Anorectal malformations (ARMs) are associated with numerous congenital anomalies including vertebral, cardiac, tracheoesophageal, renal, and limb anomalies, commonly known as the VACTERL association, with varying incidence of 7% - 60% [1-10]. When feasible, all ARM patients should be evaluated for these defects in the neonatal period or at the time of presentation. Cardiac anomalies in particular are common and confer a significantly increased risk of mortality, especially in the low- and middle-income country setting [11]. Genitourinary defects are common in ARM patients, occurring in approximately 50% of all patients with anorectal malformations [12]. Though they may be initially asymptomatic, renal and other genitourinary anomalies can lead to end-stage renal disease and lower urinary tract dysfunction, contributing to mortality and decreased quality of life for these patients [13].

In low-income countries (LICs), there are several challenges limiting the evaluation of genitourinary anomalies - including but not limited to, insufficient investigative capacities in most healthcare facilities, delayed presentation in Uganda [14-20] requiring urgent surgical intervention, and the high prevalence of home births aided by traditional birth attendants compounded by societal factors like poverty and lack of education [19,21]. High costs limit the availability of diagnostic modalities such as MRI in most LIC hospitals [15]. Additionally, resource constraints have prohibited the implementation of a comprehensive protocol to detect these associated anomalies at the time of patient presentation at our institution.

Ultrasound has recently become more readily available in our setting. Here, we aimed to use screening ultrasound to identify urological anomalies associated with anorectal malformations in previously asymptomatic children in southwestern Uganda.

Methods and Materials

Study setting and design:

This was a descriptive retrospective cohort study conducted at a regional referral hospital in Southwestern Uganda involving 133 participants who have undergone surgical correction of ARMs between June 2021 and July 2023. Our hospital is a 600-bed Government Referral Hospital, located in Mbarara City in southwestern Uganda with a catchment population of over 5-million people. Additionally, we receive patients from Democratic Republic of Congo. Up to one third of our patient census are refugees from the Nakivale Refugee Settlement, one of the largest refugee settlements in the region. The Pediatric Surgery unit (PSU) comprises 14 pediatric beds and 3 neonatal beds, and treats an average of 309 patients each month. The unit carries out an average of 62 procedures each month with 10-15% of operations on the PSU are on refugee children. The unit receives 1-3 ARM patients per month

Participants' recruitment:

Patients with ARMs previously managed at our institution were contacted via a telephone and asked to come for evaluation. Those coming to the outpatient clinic for routine follow up were assessed for associated renal anomalies using an abdominal ultrasound scan done by a radiographer. All images were interpreted with one radiologist and crosschecked with a second radiologist to confirm the findings. The participants were compensated for their time and transport funds were reimbursed using the prevailing public transport rates at the time.

Data sources:

Patients were identified and recruited through the existing ARMs support group database via phone calls. We all children with a previous diagnosis of ARM were eligible for inclusion in this study. We identified 167 participants who were eligible for inclusion in this study. We were able to reach out to 140 by phone calls, 133 presented for outpatient follow up, and all the 133 were enrolled. The required information was obtained from parents by the interviewers who were trained in using the survey form. Informed consent was obtained.

Statistical methods:

The quality of the data collected was cross-checked daily for completeness of the questionnaires. The data collected were coded with unique identifiers and input into a REDCap database[22]. The entered data were exported to Stata version 18.0 for data cleaning and analysis. Descriptive statistics were performed with categorical variables reported as frequencies with percentages and continuous variables reported as means with standard deviations or medians with interquartile ranges as appropriate. Patient characteristics were compared by patient gender. Additionally, renal ultrasound findings were compared with the patient's anorectal malformation type. Group comparisons were performed using Chi-square tests, Fischer's exact test, Wilcoxon rank-sum tests, and Kruskal-Wallis tests, as appropriate. P values < 0.05 were considered significant.

Ethical approval was obtained from the University Faculty Research Committee (FRC), Research Ethics Committee (MUST-REC) #MUST-2021-64 and Uganda National Council of Science and Technology (UNCST) #HS1632ES.

Results

All 133 patients were evaluated, of which 51.9% and 48.1% were female and male respectively. The median age (months) of patients was 17 [IQR 8 40]. Most male patients (76.6%) had rectourethral fistulas while female patients (95.7%) had vestibular fistulas. The overall prevalence of renal anomalies in our study patient population was 18.05%. Of those with ARM-associated renal anomalies, specific anomalies included; renal agenesis (6.8%), hydronephrosis, (4.5%), duplex collecting system (3.8%), crossed fused kidney (1.5%), and ectopic kidney (0.75%). (Table 1 & 2)

Mothers were also asked about prenatal care - 95% reported attending antenatal care, 65% had prenatal ultrasound examinations, and 90% delivered in a healthcare facility. Despite this high adherence to perinatal care, all stated that no abnormalities were noted during the perinatal care visits.

Discussion

In this study, screening ultrasound was used to identify urological anomalies associated with anorectal malformations in previously asymptomatic children in southwestern Uganda. It has been well established that renal anomalies are commonly associated with ARMs, and should be screened for, ideally at the time of ARM diagnosis [23]. The prevalence of associated renal anomalies in our cohort was 18%. This is lower than what is commonly reported. There appears to be hidden mortality in our setting with severe renal anomalies or those who also have cardiac or tracheoesophageal anomalies dying in the community before reaching our centre.

The most commonly identified renal anomaly was unilateral renal agenesis (6.8%) consistent with previous findings [24]. In our cohort, none of the patients had any genitourinary symptoms, had a prior ultrasound or were otherwise previously screened for associated renal anomalies. Without a screening ultrasound, these patients' would not have been diagnosed until they developed symptomatic and potentially irreversible upper or lower urinary tract dysfunction. This underscores the importance of thorough evaluation and a multidisciplinary approach of care and follow-up system for ARM management including urologists well before the children are symptomatic.

We were able to classify ARM diagnosis as anal stenosis, perineal fistula, rectourethral fistula and vestibular fistula. Incomplete operative reports and patient files prohibited the classification of patients with the level of nuance described in the Krickbeck anatomic classification[1]. One female had Meyer-Rokitansky syndrome and underwent multidisciplinary reconstruction.[25] We did find a statistically significant relationship between associated renal anomalies and type of malformation. Renal agenesis was most commonly associated with vestibular fistula (10.6%). Of the males that had unilateral renal agenesis, one presented with ipsilateral inguinal hernia and was intraoperatively found to

have an absent vas deferens and normal testis. Previous studies have demonstrated that genitourinary anomalies were more common in patients with a high type of ARM than in patients with a low type of ARM. [26] Patients with recto-vesical fistula with the highest proportion of genitourinary malformations [27] [28].

Ultrasound is a safe and inexpensive imaging modality with no radiation that has become increasingly available in LIC settings. We strongly advocate for its use in assessing patients with ARMs. Centers with access to ultrasound should work to improve surveillance of associated renal anomalies associated with ARMs [29]. Multidisciplinary management of ARMs including urologists should be encouraged given the long term potential for substantial morbidity and mortality due to upper and lower urinary tract dysfunction in this population [24]. Additionally, we encourage the utilization of ultrasound in the long follow-up for these patients when feasible.[24] We have plain X-ray available to assess the spine and sacrum in addition to magnetic resonance imaging (MRI) which has been recently installed at our centre. We now routinely use plain films for determining sacral ratio and hence predict continence in these patients. We do not have the capacity to routinely perform cystography in our setting. For patients with complex urologic anatomy, such as cloaca and persistent urogenital sinus, we rely on our collaborators and partners from HICs to bring scopes in order to clearly define the anatomy prior to reconstructive surgery. We schedule these cases to coincide with collaborators' trips to our centre. We recognize that ideally, all these children would be scoped prior to reconstruction. We are working with HIC partners to build the capacity to for routine cystography in our setting.

Despite high attendance for perinatal care, 93% of those surveyed reported adherence, no anomalies were diagnosed. Previous studies in our region have demonstrated that even when mothers receive perinatal care, it is almost always below the standard recommended by the WHO [30]. Though antenatal care and facility-based deliveries have increased, the quality of care is insufficient [31-34]. A lack of healthcare workers hinders appropriate care provision. Greater resources are needed to ensure that anomalies are identified during perinatal care visits to ensure timely intervention [22-25]. This is echoed in our findings, as the anorectal malformation-associated renal anomalies can detected on neonatal ultrasound, though none of the renal anomalies were detected prenatally in our cohort [35].

This study was limited by its retrospective nature and incomplete patient records. Additionally, there was the potential for selection bias since only patients with available telephone contacts were enrolled. Strategies employed to address these included using alternative telephone contacts when available and using addresses to trace the participants. We were unable to offer additional investigations such as lumbosacral MRI to detect other anomalies such as a tethered spinal cord due lack of availability of the equipment at our institution. The median age of presentation was 17 months, prohibiting the use of spinal ultrasound in this cohort. Additionally, we were unable to evaluate for cardiac anomalies due to lack of echocardiograph machine [36]. Our next steps include improving our digital records and more thorough documentation of the diagnosis using the Krickenbeck anatomic classification[1]. Additionally, we are strengthening the existing multidisciplinary efforts to involve urologists in the care of children with ARMs for continuous proper evaluation since most of the children are enrolled in long-term follow-up [24,29,37]. Many of these patients

have been enrolled in bladder management in conjunction with our newly established bowel management program [38]. In addition, we now routinely assess for renal and vertebral anomalies for all our newly diagnosed ARM patients using abdominal and spinal ultrasound scan.

Conclusion

There is a high prevalence of ultrasound detected urological anomalies associated with anorectal malformations in previously asymptomatic children in southwestern Uganda. Given the potential for long term morbidity and mortality, patients with anorectal malformations in all settings should be screened for genitourinary anomalies when feasible.

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References

- [1]. Holschneider A, Hutson J, Peña A, Bekhit E, Chatterjee S, Coran A, et al. Preliminary report on the International Conference for the Development of Standards for the Treatment of Anorectal Malformations. *J Pediatr Surg*, vol. 40, 2005. 10.1016/j.jpedsurg.2005.08.002.
- [2]. Górecki W Operative Pediatric Surgery, Spitz L and Coran AG (eds). *World J Surg* 2009;33. 10.1007/s00268-009-9976-7.
- [3]. Endo M, Hayashi A, Ishihara M, Maie M, Nagasaki A, Nishi T, et al. Analysis of 1,992 patients with anorectal malformations over the past two decades in Japan. *J Pediatr Surg* 1999;34. 10.1016/S0022-3468(99)90494-3.
- [4]. Rintala RJ, Lindahl HG, Rasanen M. Do children with repaired low anorectal malformations have normal bowel function? *J Pediatr Surg* 1997;32. 10.1016/S0022-3468(97)90628-X.
- [5]. Menon P, Rao KLN. Primary anorectoplasty in females with common anorectal malformations without colostomy. *J Pediatr Surg* 2007;42. 10.1016/j.jpedsurg.2007.01.056.
- [6]. Ahmadi J, Kajbafzadeh A, Kalantari M, Nahvi M, Hadipoor A, Ashjaei B, et al. Evaluation of sacral ratio as a prognostic factor in patients with anorectal malformations. *Acta Med Iran* 2005;43.
- [7]. Westgarth-Taylor C, Westgarth-Taylor T, Wood R, Levitt M. Imaging in anorectal malformations: What does the surgeon need to know? *South African Journal of Radiology* 2015;19. 10.4102/sajr.v19i2.903.
- [8]. Ralls M, Thompson BP, Adler B, Ma G, Bates DG, Kraus S, et al. Radiology of anorectal malformations: What does the surgeon need to know? *Semin Pediatr Surg* 2020;29. 10.1016/j.sempedsurg.2020.150997.
- [9]. Mortensen N. Atlas of surgical management of anorectal malformations. A. Peña. 180 × 260 mm. Pp. 104. illustrated. 1990. New York: Springer-Verlag. £60.00 hardback. *British Journal of Surgery* 2005;77. 10.1002/bjs.1800770948.
- [10]. Warne SA, Godley ML, Owens CM, Wilcox DT. The validity of sacral ratios to identify sacral abnormalities. *BJU Int* 2003;91. 10.1046/j.1464-410X.2003.04114.x.

- [11]. Mat Bah MN, Zahari N, Kasim AS, Mohamed Sharif NL. Survival and factors associated with mortality among infants with anorectal malformation: a population-based study from a middle-income country. *Eur J Pediatr* 2024;183. 10.1007/s00431-023-05292-7.
- [12]. Levitt MA, Peña A. Anorectal malformations. *Orphanet J Rare Dis* 2007;2:1–13. [PubMed: 17204147]
- [13]. Goossens WJH, De Blaauw I, Wijnen MH, De Gier RPE, Kortmann B, Feitz WFJ. Urological anomalies in anorectal malformations in the Netherlands: Effects of screening all patients on long-term outcome. *Pediatr Surg Int* 2011;27. 10.1007/s00383-011-2959-4.
- [14]. Eltayeb AA. Delayed presentation of anorectal malformations: The possible associated morbidity and mortality. *Pediatr Surg Int* 2010;26. 10.1007/s00383-010-2641-2.
- [15]. Oyania F, Kotagal M, Situma M. 15-Year-old with neglected recto-vestibular fistula in western Uganda: a case report. *J Med Case Rep* 2021;15. 10.1186/s13256-021-02717-5.
- [16]. Jamison DT, Alwan A, Mock CN, Nugent R, Watkins D, Adeyi O, et al. Universal health coverage and intersectoral action for health: key messages from Disease Control Priorities, 3rd edition. *The Lancet* 2018;391:1108–20. [https://doi.org/10.1016/S0140-6736\(17\)32906-9](https://doi.org/10.1016/S0140-6736(17)32906-9).
- [17]. Jamison DT. Disease control priorities: improving health and reducing poverty. *The Lancet* 2018;391:e11–4.
- [18]. Kakembo N, Godier-Furnemont A, Nabirye A, Cheung M, Kisa P, Muzira A, et al. Barriers to Pediatric Surgical Care in Low-Income Countries: The Three Delays' Impact in Uganda. *Journal of Surgical Research* 2019;242. 10.1016/j.jss.2019.03.058.
- [19]. Alberti P, Kisa P. Paediatric surgery in Uganda: current challenges and opportunities. *Discover Health Systems* 2024;3:29.
- [20]. Kayima P, Kitya D, Punchak M, Anderson GA, Situma M. Patterns and treatment outcomes of anorectal malformations in Mbarara Regional Referral Hospital, Uganda. *J Pediatr Surg* 2019;54. 10.1016/j.jpedsurg.2018.07.019.
- [21]. Atwiine B, Mdoka C, Branchard M, Chagaluka G, Fufa D, Ayalew M, et al. Prevention of treatment abandonment remains an important challenge to increase survival of Wilms tumor in sub-Saharan Africa: A report from Wilms Africa-CANCaRe Africa. *Pediatr Blood Cancer* n.d.:e31069.
- [22]. Wright A. REDCap: A tool for the electronic capture of research data. *Journal of Electronic Resources in Medical Libraries* 2016;13:197–201.
- [23]. vd Merwe E, Cox S, Numanoglu A. Anorectal malformations, associated congenital anomalies and their investigation in a South African setting. *Pediatr Surg Int* 2017;33. 10.1007/s00383-017-4109-0.
- [24]. Harisankar CNB, Mittal BR, Bhattacharya A, Sunil HV, Singh B, Rao KLN. Potential diagnostic role of renal scintigraphy in the management of patients with high anorectal malformation. *Hell J Nucl Med* 2009;12.
- [25]. Oyania F, Commander SJ, Mugarura R, Situma M. 3-year-old with Mayer–Rokitansky–Küster–Hauser syndrome and anorectal malformation: A case report. *Int J Surg Case Rep* 2023;106. 10.1016/j.ijscr.2023.108120.
- [26]. Mittal A, Airon RK, Magu S, Rattan KN, Ratan SK. Associated anomalies with anorectal malformation (ARM). *Indian J Pediatr* 2004;71. 10.1007/BF02724292.
- [27]. Nah SA, Ong CCP, Lakshmi NK, Yap TL, Jacobsen AS, Low Y. Anomalies associated with anorectal malformations according to the Krickenbeck anatomic classification. *J Pediatr Surg*, vol. 47, 2012. 10.1016/j.jpedsurg.2012.09.017.
- [28]. Shenoy NS, Kumbhar V, Basu KS, Biswas SK, Shenoy Y, Sharma CT. Associated anomalies with anorectal malformations in the Eastern Indian population. *Journal of Pediatric and Neonatal Individualized Medicine* 2019;8. 10.7363/080214.
- [29]. Pengvanich P, Mungnirandr A, Ruangtrakool R. Associated genitourinary abnormalities in low-type anorectal malformation and urological investigations. *Journal of the Medical Association of Thailand* 2017;100.
- [30]. Muwema M, Kaye DK, Edwards G, Nalwadda G, Nangendo J, Okiring J, et al. Perinatal care in Western Uganda: Prevalence and factors associated with appropriate care among women attending three district hospitals. *PLoS One* 2022;17. 10.1371/journal.pone.0267015.

- [31]. Dey T, Ononge S, Weeks A, Benova L. Immediate postnatal care following childbirth in Ugandan health facilities: An analysis of Demographic and Health Surveys between 2001 and 2016. *BMJ Glob Health* 2021;6. 10.1136/bmjgh-2020-004230.
- [32]. Ndugga P, Namiyonga NK, Sebuwufu D ogratious. Determinants of early postnatal care attendance: analysis of the 2016 Uganda demographic and health survey. *BMC Pregnancy Childbirth* 2020;20. 10.1186/s12884-020-02866-3.
- [33]. Mwebesa E, Kagaayi J, Ssebagereka A, Nakafeero M, Ssenkusu JM, Guwatudde D, et al. Effect of four or more antenatal care visits on facility delivery and early postnatal care services utilization in Uganda: a propensity score matched analysis. *BMC Pregnancy Childbirth* 2022;22. 10.1186/s12884-021-04354-8.
- [34]. Babughirana G, Gerards S, Mokori A, Nangosha E, Kremers S, Gubbels J. Maternal and newborn healthcare practices: assessment of the uptake of lifesaving services in Hoima District, Uganda. *BMC Pregnancy Childbirth* 2020;20. 10.1186/s12884-020-03385-x.
- [35]. Sangkhathat S, Patrapinyokul S, Tadtayathikom K. Associated genitourinary tract anomalies in anorectal malformations: A thirteen year review. *Journal of the Medical Association of Thailand* 2002;85.
- [36]. KHALEGHNEZHAD TA, Saeeda M. The results of posterior sagittal anorectoplasty in anorectal malformations 2005.
- [37]. Ganesan I, Rajah S. Urological anomalies and chronic kidney disease in children with anorectal malformations. *Pediatric Nephrology* 2012;27. 10.1007/s00467-012-2128-6.
- [38]. Trinidad S, Oyania F, Bingana C, Nuwagaba I, Obermeyer M, Odongo C, et al. Pilot bowel management program at Mbarara Hospital, Uganda. *Pediatr Surg Int* 2023;39:292. [PubMed: 37962686]

Table:

Main Findings

	Male N= 64 (48.1%)	Female N= 69 (51.9%)	All Patients N=133
Median Age (months) [IQR]	17 [8 37.5]	16 [6 48]	17 [8 40]
Renal Ultrasound Findings			
Normal	52 (81.3%)	57 (82.6%)	109 (81.95%)
Crossed fused kidney	1 (1.6%)	1 (1.4%)	2 (1.5%)
Duplex collecting system	3 (4.8%)	2 (2.9%)	5 (3.8%)
Ectopic kidney	1 (1.6%)	0 (0%)	1 (0.75%)
Hydronephrosis	4 (6.4%)	2 (2.9%)	6 (4.5%)
Renal agenesis	2 (3.2%)	7 (10%)	9 (6.8%)

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Table 1:

Baseline characteristics

	Male N= 64 (48.1%)	Female N= 69 (51.9%)	All Patients N=133	P-value
Median Age (months) [IQR]	17 [8 37.5]	16 [6 48]	17 [8 40]	0.742
ARM Type				<0.001
Anal stenosis	2 (3.2%)	1 (1.5%)	3 (2.3%)	
Perineal fistula	13 (20.6%)	2 (2.9%)	15 (11.3%)	
Rectourethral fistula	49 (76.6%)	0 (0%)	49 (36.8%)	
Vestibular fistula	0 (0%)	66 (95.7%)	66 (49.6%)	
Renal Ultrasound Findings				0.421
Normal	52 (81.3%)	57 (82.6%)	109 (81.95%)	0.839
Crossed fused kidney	1 (1.6%)	1 (1.4%)	2 (1.5%)	0.957
Duplex collecting system	3 (4.8%)	2 (2.9%)	5 (3.8%)	0.671
Ectopic kidney	1 (1.6%)	0 (0%)	1 (0.75%)	0.481
Hydronephrosis	4 (6.4%)	2 (2.9%)	6 (4.5%)	0.427
Renal agenesis	2 (3.2%)	7 (10%)	9 (6.8%)	0.167

Data presented as N (%) unless otherwise specified. Percentages may not add up to 100 due to rounding or missing values. Abbreviations: IQR=interquartile range.

Table 2:

Type of ARM Vs type of Renal anomaly

	Anal stenosis N=3 (2.3%)	Perineal fistula N=15 (11.3%)	Rectourethral fistula N=49 (36.8%)	Vestibular fistula N=66 (49.6%)	All Patients N=133	P-value	Overall P-value
Normal	2 (66.7%)	10 (66.7%)	43 (87.8%)	54 (81.8%)	109 (81.95%)	0.208	0.047
Crossed fused kidney	0 (0%)	0 (0%)	1 (2%)	1 (1.5%)	2 (1.5%)	0.946	
Duplex collecting system	0 (0%)	2 (13.3%)	1 (2%)	2 (3%)	5 (3.8%)	0.277	
Ectopic kidney	0 (0%)	1 (6.7%)	0 (0%)	0 (0%)	1 (0.75%)	0.135	
Hydronephrosis	0 (0%)	2 (13.3%)	2 (4.1%)	2 (3%)	6 (4.5%)	0.342	
Renal agenesis	0 (0%)	0 (0%)	2 (4.1%)	7 (10.6%)	9 (6.8%)	0.407	

Data presented as N (%) unless otherwise specified. Percentages may not add up to 100 due to rounding or missing values. Abbreviations: IQR=interquartile range.