Section: Miscellaneous

Original Research Article

CLINICO- RADIOLOGICAL CORRELATION IN PEDIATRIC CELLULITIS AND ABSCESSES: ROLE OF ULTRASOUND AND MRI IN DIAGNOSTIC ACCURACY AND MANAGEMENT

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ABSTRACT

Background: Differentiating cellulitis from abscess in children is challenging, as clinical features often overlap. Accurate diagnosis is essential for appropriate management, with antibiotics indicated for cellulitis and surgical drainage required for abscesses. The aim is to evaluate the clinico radiological correlation in pediatric cellulitis and abscesses, emphasizing the role of ultrasound and MRI in diagnostic accuracy and management decisions.

Materials and Methods: A prospective observational study was conducted on 80 pediatric patients (45 cellulitis, 35 abscess). Clinical features, laboratory findings, and imaging results were analyzed. Ultrasound was performed in all cases, while MRI was reserved for inconclusive or complex presentations. Management plans before and after imaging were compared.

Results: Fever, swelling, and tenderness were common in both groups, but swelling was significantly higher in abscess cases (p=0.03). Ultrasound showed sensitivity and specificity of 85% and 80%, while MRI achieved 97% and 92%, respectively. Imaging altered management in 13% of cases, reducing antibiotic only treatment and increasing surgical drainage or combined therapy.

Conclusion: Ultrasound is a reliable first line tool, while MRI provides superior accuracy in complex cases. Clinico radiological correlation ensures rational antibiotic use, timely surgical intervention, and improved pediatric outcomes.

Keywords: Pediatric cellulitis, abscess, ultrasound, MRI.

INTRODUCTION

Skin and soft tissue infections (SSTIs) such as cellulitis and abscesses are common causes of pediatric hospital visits and represent a significant burden in emergency and inpatient care. Differentiating between cellulitis and abscess is crucial, as cellulitis generally responds to antibiotics, whereas abscesses require surgical drainage for definitive management. Clinical examination alone often lacks sensitivity and specificity, leading to misclassification and inappropriate treatment strategies.[1]

Ultrasound has emerged as a valuable first line imaging modality in children due to its accessibility, non invasiveness, and absence of radiation. Studies have demonstrated that point of care ultrasound (POCUS) achieves pooled sensitivity of approximately 90% and specificity of 80% in distinguishing abscess from cellulitis, outperforming clinical examination alone.[2] Ultrasound can also detect deeper collections and guide drainage procedures, thereby reducing unnecessary antibiotic use and improving outcomes.

Magnetic Resonance Imaging (MRI), although less frequently used due to cost and availability, provides superior soft tissue resolution and is particularly useful in cases where ultrasound findings are inconclusive or deeper extension is suspected. MRI has demonstrated sensitivity and

specificity exceeding 90% in pediatric musculoskeletal and soft tissue infections, making it the gold standard for complex or atypical presentations.[3]

Clinico radiological correlation is therefore essential in pediatric cellulitis and abscesses. By integrating clinical findings with imaging modalities, physicians can achieve higher diagnostic accuracy, optimize treatment decisions, and reduce complications. This study aims to evaluate the role of ultrasound and MRI in improving diagnostic precision and guiding appropriate management in pediatric patients with cellulitis and abscesses.

Aim & Objectives:

Aim: To evaluate the clinico radiological correlation in pediatric cellulitis and abscesses, with particular emphasis on the role of Ultrasound and MRI in appropriate management decisions.

Objectives

1. To analyze the demographic and clinical profile of pediatric patients presenting with cellulitis and abscesses.
2. To assess the diagnostic accuracy of Ultrasound and MRI in differentiating cellulitis from abscess and in delineating the extent of infection.
3. To correlate clinical findings with radiological outcomes, thereby determine how imaging influences treatment outcomes.

MATERIALS AND METHODS

This was a prospective observational study conducted on 80 pediatric patients presenting with soft tissue infections, clinically diagnosed as cellulitis or abscess. The study was carried out jointly in the Departments of Radiology, Pediatrics, and Dermatology at Madhubani Medical College and Government Medical College, Gondia.

Inclusion Criteria:

a) Children aged 2–14 years
b) Clinical suspicion of cellulitis or abscess based on swelling, pain, fever, and local tenderness
c) Patients presenting for the first time with acute soft tissue infection

Exclusion Criteria:

a) Children with chronic systemic illnesses (e.g., diabetes mellitus, congenital immunodeficiency)
b) Patients already on prolonged antibiotic therapy before presentation
c) Recurrent or chronic abscesses
d) Incomplete clinical or imaging data

Clinical Evaluation: All patients underwent a detailed history and physical examination. Demographic details such as age, sex, locality, and nutritional status were recorded. Clinical features including fever, swelling, tenderness, and systemic signs were documented. Laboratory investigations included complete blood count, leukocyte count, and C reactive protein (CRP) levels.

Radiological Procedure:

a) Ultrasound (USG): Performed as the first line imaging modality using high frequency linear probes. Findings such as soft tissue edema, hypoechoic fluid collections, and abscess cavities were noted.
b) Magnetic Resonance Imaging (MRI): Conducted in cases where ultrasound was inconclusive or deeper extension was suspected. MRI sequences included T1 weighted, T2 weighted, and contrast enhanced imaging to delineate infection extent and differentiate cellulitis from abscess.

Management Plan:

Initial treatment decisions were based on clinical and laboratory findings. After imaging, management was reassessed and categorized into four groups:

1. Antibiotics only
2. Surgical drainage only
3. Combined therapy (antibiotics + drainage)
4. Supportive/conservative care (observation, analgesia, hydration)

Statistical analysis: Categorical variables such as gender, locality, and clinical features were expressed as percentages and compared using the chi square test. Continuous variables such as age were expressed as mean ± standard deviation and analyzed using the t test. A p value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Variables

Sr No	Variables	Cellulitis (n=45)	Abscess (n=35)	Total (n=80)
1	Age (Years) (mean ± SD)	7.2 ± 3.1	8.1 ± 2.8	7.6 ± 3.0
2	Gender a. Male b. Female	 28 (62.2%) 17 (37.8%)	 20 (57.1%) 15 (42.9%)	 48 (60.0%) 32 (40.0%)
3	Locality a. Urban b. Rural	 30 (66.7%) 15 (33.3%)	 22 (62.9%) 13 (37.1%)	 52 (65.0%) 28 (35.0%)
4	Nutritional Status a. Malnourished b. Normal	 12 (26.7%) 33 (73.3%)	 10 (28.6%) 25 (71.4%)	 22 (27.5%) 58 (72.5%)

The study included 80 pediatric patients, of which 45 presented with cellulitis and 35 with abscesses. The mean age was slightly higher in the abscess group (8.1 ± 2.8 years) compared to the cellulitis group (7.2 ± 3.1 years), suggesting that abscess formation may occur in relatively older children.

Males constituted the majority in both groups (62.2% in cellulitis and 57.1% in abscess), with an overall male predominance (60%). Urban children were more frequently affected (65%), possibly reflecting higher healthcare access or exposure patterns. Nutritional status showed that nearly one fourth of patients were malnourished (27.5%), indicating that poor nutrition may predispose to severe infections.

Table 2: Clinical Presentation and Laboratory Findings

Sr No	Clinical Feature	Cellulitis (n=45)	Abscess (n=35)	P value
1	Fever (>38°C)	32 (71%)	28 (80%)	0.42 (NS)
2	Local Swelling	40 (89%)	35 (100%)	0.03 (S)
3	Tenderness	42 (93%)	34 (97%)	0.51 (NS)
4	Leukocytosis (>12,000/mm³)	30 (67%)	29 (83%)	0.12 (NS)
5	Elevated CRP (>10 mg/L)	35 (78%)	31 (89%)	0.18 (NS)

Fever was common in both groups, seen in 71% of cellulitis and 80% of abscess cases, though the difference was not statistically significant. Local swelling was universal in abscess cases (100%) and significantly higher compared to cellulitis (89%, p=0.03), highlighting its diagnostic importance. Tenderness was present in almost all patients (93% vs 97%), showing no significant difference. Leukocytosis was more frequent in abscesses (83%) than cellulitis (67%), while elevated CRP was also higher in abscesses (89% vs 78%). These findings suggest that while systemic inflammatory markers are raised in both conditions, they tend to be more pronounced in abscesses.

Table 3: Radiological Correlation (Ultrasound vs MRI)

Sr No	Imaging Modality	Cellulitis (n=45)	Abscess (n=35)	Sensitivity	Specificity
1	Ultrasound	38 (84%)	30 (86%)	85%	80%
2	MRI	44 (98%)	34 (97%)	97%	92%
3	Average Concordance of imaging with Clinical Diagnosis	91.1 %	91.4 %	–	–

Ultrasound detected cellulitis in 84% and abscesses in 86% of cases, with sensitivity and specificity of 85% and 80%, respectively. MRI demonstrated superior diagnostic accuracy, identifying cellulitis in 98% and abscesses in 97%, with sensitivity of 97% and specificity of 92%. The concordance of imaging with clinical diagnosis was high for both modalities, averaging around 91%. This indicates that while ultrasound is a reliable first line tool, MRI provides greater precision, especially in differentiating cellulitis from abscess and guiding management decisions.

Table 4: Impact on Management

Sr No	Management Decision	Initial Plan	Plan after imaging	Change in Initial Plan
1	Antibiotics Only	30 (37.5%)	25 (31.3%)	5 ↓ (6.2%)
2	Surgical Drainage Only	10 (12.5%)	15 (18.8%)	5 ↑ (6.2%)
3	Combined Therapy (Antibiotics + Drainage)	25 (31.3%)	30 (37.5%)	5 ↑ (6.2%)
4	Supportive/Conservative Care (Observation, Analgesia, etc.)	15 (18.8%)	10 (12.5%)	5 ↓ (6.2%)
Total N (%)		80 (100 %)	80 (100 %)	10 (13 %)

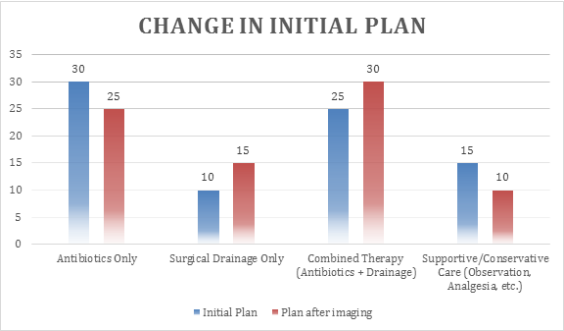

Figure 1: Impact on Management

Initial clinical plans favored antibiotics alone in 37.5% of cases, surgical drainage in 12.5%, combined therapy in 31.3%, and supportive care in 18.8%. After imaging, these proportions shifted: antibiotics alone decreased to 31.3%, surgical drainage increased to 18.8%, combined therapy rose to 37.5%, and supportive care reduced to 12.5%. Overall, 13% of patients had a change in management following imaging. This demonstrates that radiological evaluation significantly influenced treatment decisions, reducing unnecessary antibiotic use and increasing timely surgical intervention where abscesses were confirmed.

DISCUSSION

The present study demonstrated that clinical features such as fever, swelling, and tenderness were common in both cellulitis and abscess, but local swelling was significantly more frequent in abscess cases. This finding aligns with Marin et al., who reported that clinical examination alone often lacks sensitivity and specificity in differentiating cellulitis from abscess, leading to misclassification and inappropriate treatment[1]. Our results confirm that while clinical signs are useful, they cannot reliably

distinguish between the two conditions without radiological support.

Ultrasound in our study detected cellulitis in 84% and abscesses in 86% of cases, with sensitivity and specificity of 85% and 80%, respectively. These values are consistent with the meta analysis by Chauhan and Singh, who found pooled sensitivity of approximately 90% and specificity of 80% for point of care ultrasound in pediatric soft tissue infections[2]. Similarly, Iverson et al. demonstrated that bedside ultrasound reduced hospital stay and improved diagnostic accuracy in pediatric SSTIs, underscoring its role in rapid decision making.[4] Gaspari et al. further highlighted that ultrasound not only improves diagnostic precision but also guides management, particularly in emergency settings.[5] The mechanism underlying ultrasound's utility lies in its ability to visualize hypoechoic fluid collections and soft tissue edema, which are not apparent on clinical examination, thereby enabling early identification of abscesses and avoiding unnecessary antibiotic therapy.

MRI in our study demonstrated superior diagnostic accuracy, identifying cellulitis in 98% and abscesses in 97%, with sensitivity of 97% and specificity of 92%. These findings are in agreement with Shah et al., who emphasized the role of rapid MRI protocols in streamlining pediatric musculoskeletal infection workup[3]. Krogstad and Edwards also noted that MRI provides superior soft tissue resolution and is particularly useful in cases where ultrasound findings are inconclusive or when deeper extension is suspected.[6] More recently, open access studies have confirmed MRI's ability to delineate complex infections, reducing misdiagnosis and ensuring timely intervention.[7] The mechanism for MRI's superiority is its high soft tissue contrast and multiplanar capability, which enables precise delineation of infection extent and deeper involvement.

Importantly, imaging influenced management decisions in 13% of cases in our study. Antibiotic only plans decreased after imaging, while surgical drainage and combined therapy increased. This reflects the impact of radiological confirmation in guiding appropriate interventions. Similar trends were observed in pediatric emergency department studies, where ultrasound significantly reduced unnecessary antibiotic use and increased timely drainage procedures.[1,2,4,5] Frontiers in Pediatrics also reported that imaging correlation improves rational antibiotic use and reduces complications in pediatric soft tissue infections.[6] The possible mechanism for these results is that imaging provides objective evidence of abscess formation, which alters the therapeutic approach from conservative antibiotic therapy to surgical intervention. Conversely, in cases where imaging rules out abscess, unnecessary invasive procedures are avoided. Thus, clinico radiological correlation ensures more rational use of antibiotics, reduces hospital stay, and improves overall outcomes.

CONCLUSION

Ultrasound and MRI significantly enhance diagnostic accuracy in pediatric cellulitis and abscesses, enabling more precise differentiation and guiding appropriate management. Imaging reduced unnecessary antibiotic use and increased timely surgical interventions, underscoring the importance of clinico radiological correlation in optimizing outcomes.

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