



# Diagnostic Utility of Wrist MRI in The Pediatric Population

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## Introduction

Pediatric patients often present with hand and wrist pain. The source of approximately 70% of wrist pain in this population can be determined by history alone.<sup>1</sup> Although plain radiographs can identify the majority of fractures and dislocations, they provide limited information on soft tissue pathology.<sup>2</sup> MRI scans have the advantage of showing both osseous and soft tissue structures. However MRI scans have a limited role as screening tool due to their high cost and limited availability.

The appropriate use of MRI imaging for evaluation of the painful wrist remains a topic of controversy. While MRI has greater sensitivity than plain radiography when evaluating for occult or incomplete fractures,<sup>3,4</sup> it also often yields positive findings in clinically asymptomatic patients.<sup>5,6</sup> Complicating this issue further, the majority of pediatric hand and wrist injuries heal spontaneously without complications or interventions,<sup>7,8</sup> making justification of expensive diagnostic tests difficult. Despite this, the American College of Radiology still recommends an MRI for all patients with chronic wrist pain following negative X-rays.<sup>9</sup>

To the best of our knowledge, no studies have explored the clinical utility of MRI in the workup of pediatric patients presenting with acute or chronic wrist pain. Here, we aim to describe an evidenced-based outcome analysis of MRI utility in a cohort of pediatric patients.

## Methods

Institutional Review Board approval was obtained. Electronic medical records were retrospectively reviewed for all consecutive patients who obtained a wrist MRI at our institution. A scoring system from 0 to 3 was developed and applied to each MRI report in order to evaluate and quantify its clinical impact

on future treatment, with 0 indicating a normal result, 1 minimal clinical impact or incidental finding (e.g. bone edema), 2 moderate clinical finding and 3 indicating a result with high/definitive clinical significance. Final variables associated with number of patients were analyzed by the Chi-square test based on the expectation of equality between the genders. All other variables were analyzed through confidence intervals.

## Results

A total of 313 records were reviewed from all patients who obtained a wrist MRI at our institution between 2007 and 2012. In that MRI is very sensitive, and incidental findings are often observed, we developed the clinical scoring system described above. As described in Table 1, analysis showed that boys were statistically more likely than girls to have an MRI with a higher clinical impact ( $p < 0.05$ ).

A specific indication for obtaining the study was noted in 171 studies (55%), with the primary indications being to assess for occult bony/ligamentous injury in those presenting with pain, characterize a mass/cyst, evaluate for suspected osteomyelitis and evaluate for arthropathy. Those studies that listed a specific reason for ordering the MRI had an average score of 1.62, while those without an indication had an average clinical score of 1.11 ( $p < 0.05$ ).

Looking at these indications further, we found that MRI was most useful in delineation of a mass, evaluating for arthropathy and evaluating osteomyelitis. Conversely, MRI was least useful in diagnosing generalized wrist pain. (Table 2) Further evaluation of the patients presenting with pain revealed neither the time frame of the pain (acute vs. chronic) nor the mechanism of injury (pain of traumatic origin vs. that of generalized/non-specific origin) had any

**Table 1. Summary of Normal MRIs and Average Clinical Score by Gender**

	Total #	# normal	% normal	Average Clinical Score	95% Confidence Interval
Total	313	81	25.9%	1.39	1.27 – 1.51
Male	126	16	12.7%	1.71	1.53 – 1.89
Female	187	65	34.8%	1.17	1.01 – 1.33

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**Table 2. MRI Analysis by Admitting Diagnosis**

	<b>Total #</b>	<b># normal</b>	<b>% normal</b>	<b>Average Clinical Score</b>	<b>95% Confidence Interval</b>
Mass/Cyst	26	0	0	2.46	2.15 – 2.78
Osteomyelitis	14	1	7.1	2.07	1.49 – 2.65
Arthropathy	18	2	11.1	1.72	1.24 – 2.20
Pain – All	224	74	33.0	1.14	1.00 – 1.28

**Table 3. MRI Analysis by Gender with Pain as an Admitting Diagnosis**

	<b>Total #</b>	<b># normal</b>	<b>% normal</b>	<b>Average Clinical Score</b>	<b>95% Confidence Interval</b>
Total	224	74	33.0	1.14	1.00 – 1.28
Male	84	14	16.7	1.5	1.28 – 1.72
Female	140	60	42.9	0.93	0.76 – 1.10

impact on clinical score or percent normal studies. Looking within the genders, girls were found to be 1.7 times more likely to present for evaluation via MRI of generalized wrist pain and 2.6 times more likely to have a normal study given the presence of wrist pain. Finally, when looking at clinical impact, males presenting with wrist pain had an average clinical score of 1.50, while females had an average score of 0.93 ( $p < 0.05$ ). (Table 3) When excluding normal studies, no differences were found between the genders.

Hand surgeons ordered the majority of MRI's (157) followed by primary care physicians (50), sports medicine physicians (48), orthopaedic surgeons (45), and rheumatologists (13). No statistical difference was noted in the clinical score or percent normal studies between these departments.

## Discussion

Our findings support the hypothesis that clinicians who have a greater suspicion for a specific condition when referring for a wrist MRI are more likely to return a clinically helpful study. Conversely, if the only presenting complaint is wrist pain, there is a higher probability for a normal study.

Our study has a number of limitations. First, only patients presenting to our institution were included. These patients, and the physicians associated with our institution, may not be representative of the population at large. Additionally, only clinical information in the referral prescription for MRI and the subsequent final radiologist report was collected.

## Conclusion

Overall, there are a wide range of factors that influence the decision-making process leading to the referral of a

pediatric patient for wrist MRI. Based on our results, we feel that wrist MRI is not an ideal screening tool in children, and should only be used to exclude or confirm a specific diagnosis, as it provides limited useful clinical information for the evaluation of generalized wrist pain.

## Disclosures

There was no outside funding for this study.

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