New Technology Rapidly Influences Orthopaedic Surgical Training: The Volar Locking Plate for the Open Reduction and Internal Fixation of Distal Radius Fractures

John Kadzielski, MD[1], George Dyer, MD[2], Philip Blazar, MD[2]
[1]Massachusetts General Hospital, [2]Brigham & Women's Hospital

ABSTRACT

INTRODUCTION: Over the last 10 years, with the advent of alternative forms of fixation for distal radius fractures, there has been a dramatic shift in the way that many distal radius fractures are treated. This trend towards open reduction and internal fixation (O.R.I.F.) has been mirrored with the near extinction of external fixation. This shift has impact on residency training programs. **METHODS:** Resident Accreditation Council for Graduate Medical Education (A.C.G.M.E.) case logs from 2001 to 2009 were reviewed. **RESULTS:** During this decade, residents reported operative management of 1079 distal radius fractures of which 72 (6.7%) were treated with percutaneous fixation and 1007 (93.3%) were treated with O.R.I.F. The peak of external fixation was in 2002 with 22.2% of the cases cared for and in 2009 only 2.5% of the cases were treated with percutaneous fixation. This trend represented a statistically significant decrease in cases treated percutaneously over the last decade (X^2 = 54.995, P<0.001). **CONCLUSIONS:** Changes in technology can drastically influence the surgical experience of surgeons-in-training in a time span of less than a decade. This fact has strong implications for Graduate Medical Education (G.M.E.) surgical curricula. The interval of curriculum reviews needs to be frequent enough to reflect these rapid shifts in management, and curricula need to stress basic principles and concepts rather than focusing on individual surgical techniques.

INTRODUCTION

Over the last decade with the advent of alternative forms of fixation for distal radius fractures, there has been a dramatic shift in the way that many distal radius fractures are treated[1]. American Board of Orthopaedic Surgery examiners have also noted this movement towards operative management in their candidates[2]. This rapid shift in surgical management has implications for orthopaedic residency training programs. The purpose of this paper is to document surgical trends in the resident surgical experience of distal radius fractures in orthopaedic residency training programs and to demonstrate the rapidity with which that change can occur. Given our observation that technology changes can drastically shift the surgical experience of surgeons in training over less than a decade, there are implications for G.M.E. surgical curricula. Specifically the interval of curriculum reviews needs to be frequent and curricula need to stress basic principles and concepts rather than focusing on individual surgical techniques.

TABLE 1

OUTDATED CPT	CURRENT CPT
25611	**25606** Percutaneous Skeletal fixation of distal radius fracture
25620	**25607** Open treatment of distal radial extra-articular fracture or epiphyseal separation with internal fixation **25608** Open treatment of distal radial intra-articular fracture or epiphyseal separation with internal fixation of 2 or more fragments **25609** Open treatment of distal radial intra-articular fracture with or without epiphyseal separation with internal fixation of 3 or more fragments

TABLE 1: Outdated and current C.P.T. codes for percutaneous fixation and O.R.I.F. of distal radius fractures.

John Kadzielski, MD
Harvard Combined Orthopaedic Residency Program
Massachusetts General Hospital - White 535
55 Fruit Street
Boston, MA 02114

George Dyer, MD
Instructor of Orthopaedic Surgery, Harvard Medical School
Department of Orthopaedic Surgery
Brigham & Women's Hospital
75 Francis Street
Boston, MA 02115

Philip Blazar, MD
Assistant Clinical Professor of Orthopaedic Surgery, Harvard Medical School
Department of Orthopaedic Surgery
Brigham & Women's Hospital
75 Francis Street
Boston, MA 02115

Corresponding Author:

John Kadzielski, MD
Harvard Combined Orthopaedic Residency Program
Massachusetts General Hospital - White 535
55 Fruit Street
Boston, MA 02114

jkadzielski@partners.org

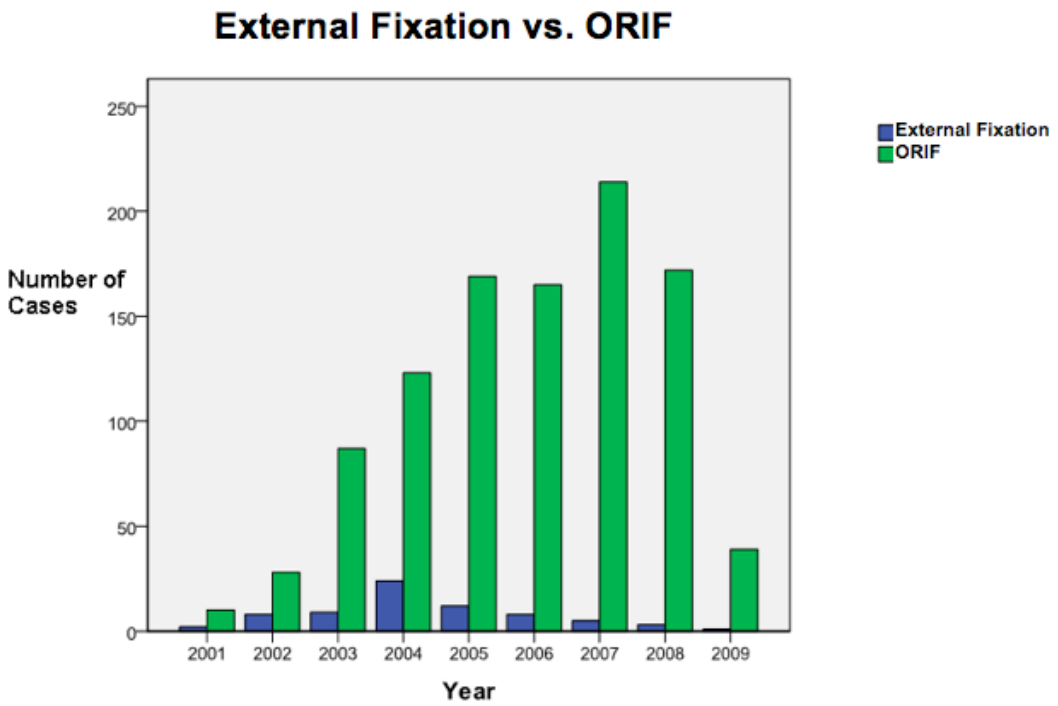

FIGURE 1: A graphical depiction of the yearly percentages of percutaneous fixation vs. O.R.I.F. of distal radius fractures from 2001 to 2009.

METHODS

Case Collection

This study was undertaken at a residency training program that encompasses four major teaching hospitals. There were 10 residents matched per year until 2003, when the class expanded to 12 residents per year. Twelve residents per year have been matched each year except 2008 when 14 were matched. One of the residency training hospitals is purely a children's hospital, and another hospital treats children as well as adults. The other two institutions are predominantly adult hospitals. The referral patterns, levels of acuity, and operative volumes in each of the hospitals were roughly constant during the study period.

A.C.G.M.E. resident case log databases were reviewed for operative management of distal radius fractures. All percutaneous fixation Current Procedural Terminology (C.P.T.) codes (25611 and 25606) were considered in the Percutaneous Fixation Category, and all of the open surgical management codes (25620 became 25607, 25608, and 25609 in 2007) were placed into the O.R.I.F. Category (Table 1). In our residency program, data was first collected via the A.C.G.M.E. log in 2001, and initially cases were not all reliably entered into the log. Subsequently compliance with the case log system has been very high. Similarly, initial data from early 2009 was included in this study even though the total year data is incomplete because it helps depict the trends in proportions of cases managed differently.

Analysis

Statistical Analysis was carried out using SPSS software. Descriptive statistics were used as well as a two-tailed Chi Square analysis to determine significant differences in trends. P values of 0.05 or less were considered statistically significant.

RESULTS

A total of 1079 cases were reported in the A.C.G.M.E. resident case logs between 2001 and 2009. Seventy-two cases (6.7%) were treated with percutaneous fixation, and 1007 (93.3%) were treated with O.R.I.F. The annual percentages of percutaneous vs. O.R.I.F. of distal radius fractures is listed in Table 2 and depicted graphically in Figure 1. Percutaneous fixation of distal radius fractures peaked in 2002 with 8 out of the 36 (22.2%) total cases of the surgically managed fractures being treated this way. The percentage of percutaneously pinned fractures has trailed off to roughly 2% yearly with a total of 5 fractures repaired this way in 2007, 3 in 2008, and 1 in 2009. The overall number of fractures treated with percutaneous fixation vs. O.R.I.F. is statistically significant (X^2 = 54.995, $P<0.001$).

DISCUSSION

Using data from Part II ABOS case lists, Koval and colleagues recently reported on the rapid increase in the use of volar locked plating to treat distal radius fractures since its introduction[2]. In this study, using resident case-log data we report an even more rapid increase in this trend among surgeons in major teaching hospital system. Other fundamental

TABLE 2

	Surgical Technique		
	Percutaneous Pinning	ORIF	Total
2001	2 16.7%	10 83.3%	12
2002	8 22.2%	28 77.8%	36
2003	9 9.4%	87 90.6%	96
2004	24 16.3%	123 83.7%	147
2005	12 6.6%	169 93.4%	181
2006	8 4.6%	165 95.4%	173
2007	5 2.3%	214 97.7%	219
2008	3 1.7%	172 98.3%	175
2009	1 2.5%	39 97.5%	40
Total	72 6.7%	1007 93.3%	1079

TABLE 2: The annual percentages of percutaneous fixation vs. O.R.I.F. of distal radius fractures.

methods of managing these injuries such as external fixation or pin-in-plaster fixation have been almost entirely eclipsed over a very brief period.

When such rapid and complete change occurs in teaching hospitals it may have profound implications for practice patterns in orthopaedic surgery. Our data suggest that newly trained surgeons may have little or no experience with any operative way to treat a distal radius fracture other than with a volar locked plate. As this generation of surgeons enter practice we should expect to see the trend that Koval and colleagues identified accelerate even more dramatically.

We would like to make it clear that the purpose of this paper is not to dispute the merits of volar plating. There is a growing body of evidence that supports the usage of these plates, especially in patients who demand early function during the immediate post-operative period[3-8]. However, there is no evidenced-based consensus on the surgical technique which provides the best overall outcome for the management of distal radius fractures[9-11]. When directly compared to Kirshner-wire augmented external fixation, one study suggested that there is early improvement in self-reported disability at 3 months for patients treated with volar fixed-angle plates, but at 6 months and at one year there was no significant difference[11]. A second head-to-head study reported a non-significant trend towards less patient-reported disability at three months for those treated with volar locked plates vs. bridging external fixation, but this equalized over a year[12]. A third study with 12-24 months of follow-up found no significant difference in self-reported outcomes between external fixation and volar fixed-angle plates despite significantly different ulnar variance and articular step off measurements in favor of volar plating[13]. Nonspanning external fixators have been shown to be biomechanically equivalent for the management of unstable distal radius fractures[14], and data shows that dorsal Pi plating offers superior biomechanical performance when compared to volar constructs[15]. Additionally, volar plate fixation is not without its own complications including loss of reduction of the lunate facet[16], flexor carpi radilis rupture, flexor tendon injury[17], and flexor pollicis longus rupture[18].

Our broader point is that the rapid adoption of this technology, whether warranted or not, has been done without strict evidence-based principles and has had a significant impact on residency training. This paper, which documents the recent shift in resident experience and its rapidity, mandates regular curriculum review to ensure that basic core procedures and concepts are taught to residents who may only gain exposure to the latest surgical trends during their residency.

Surgeon educators have the responsibility to acknowledge the drawbacks of modern treatments and to review the historical principles underlying today's techniques so that the current generation of residents has a strong foundation of operative, anatomic, and biomechanical principles so that they may adequately evaluate future treatment shifts. Furthermore, treatment shifts are likely to happen at an accelerated pace given the widely implemented orthopaedic educational infrastructure and dissemination of orthopaedic written materials. The ability to adapt to these changes should be incorporated into the Residency Review Committee's "Special Requirements" for orthopaedic surgery programs[19] and should become an established standard for quality education[20]. It is the responsibility of residency training programs to acknowledge this, review their curricula regularly, and provide access to a solid core of fundamental principles to help their residents understand and navigate these inevitable and increasingly frequent treatment revolutions.

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