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The Relationship of Personality Style and Attention Deficit Hyperactivity Disorder in Children

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ABSTRACT

Introduction. This study was to identify personality correlates of children with a diagnosis of Attention Deficit Hyperactive Disorder (ADHD). The Jungian Personality Type dimensions primarily considered were Sensing/Intuiting and Perceiving/Judging. A Sensing child is likely to be very present-centered. A Perceiving child tends to be curious and resist order and structure.

Methods. Children attending a general pediatric clinic with a diagnosis of ADHD were eligible to participate. Enrolled children were administered the Murphy-Meisgeier Type Indicator for Children. Binomial tests were performed comparing Perceiving and Sensing personality components to accepted population rates.

Results. Participants (n = 117) were predominantly male (78%) with a median age of 10 years. The Sensing trait (72%) was more prevalent than expected, though prevalence for the Perceiving trait (44%) did not differ from population rates.

Conclusions. Personality types occasioned with the diagnosis of ADHD could be useful in establishing/normalizing treatment regimens and approaches to assist these children and their families better. ***KS J Med 2017;10(2):26-29.***

INTRODUCTION

Attention Deficit/Hyperactivity Disorder (ADHD) is a condition characterized by high levels of hyperactivity/impulsivity and inattention that affects up to 10% of school-age children.[1] ADHD is associated with chronic functional impairment and increased risk for later psychopathology.[2,3] The specific disorder, as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), includes operational criteria targeting both behaviors and deficits in abilities including inattention and communication/impulsivity.[4] A search of the literature focused on the relationship of personality characteristics/traits and ADHD revealed a preponderance of research identifying negative aspects associated with the diagnosis, including increased risk of injury, reduced educational achievement, and economic impact.[5,6] There was a paucity of research aimed at identifying positive aspects of the diagnosis or ways in which ADHD symptomatology combines favorably with life's demands. In addition, most research of ADHD and personality focused on adults and not children.

Once thought to disappear with maturation, longitudinal studies have shown ADHD symptoms generally manifest themselves in early childhood, prior to age 12, and can be present in some form throughout adulthood.[6-8] Depending on informant and diagnostic cutoff points, anywhere from 5 to 75% of adults diagnosed as children show significant levels of impairment into adulthood.[9] Some have suggested a relationship between disorders of neurocognitive and/or executive function (e.g., ADHD) and subsequent psychopathology (e.g., personality disorders) in adulthood.[6,10] However, others have argued the constructs associated with ADHD may be adaptive and represent a positive adjustment to a disorganized and chaotic world.[11,12]

Core symptoms of ADHD may shift in adulthood.[13] Behaviors such as difficulty maintaining attention and frequent running around shift to affective lability, lack of anger management skills, emotional over-reactivity, and disorganization. However, coupled with this are concomitant spontaneity, creativity, and responsiveness. Many of the traits associated with creative individuals overlap substantially with behavioral descriptions of ADHD, including higher levels of spontaneous idea generation, mind wandering, daydreaming, sensation seeking, energy, and impulsivity.[14] In addition, persons with diagnosed ADHD may be more likely to convert the exhaustive effects of the disorder into exceptional qualities. Barkley[15] noted that children with ADHD actually are able to concentrate intently; this is especially true when the endeavor interests them or provides immediate reinforcement and feedback. Those with an ADHD diagnosis activate higher levels of creative thought and achievement than people without the diagnosis.[16,17] This leads to questions concerning what factors contribute to success of those with ADHD and whether they might be functions of personality.

The key constructs of ADHD often appear to be transient. Hyperactivity often declines by adolescence but problems with attention remain.[18] Impulsivity may transform from acting without thinking into executive function issues including problems in self-reflection, planning, and creating a future orientation that anticipates outcomes. However, this also may give way to fearless negotiation of life circumstances that sometimes leads to surprisingly creative solutions.[19] Adults with ADHD also reported occasional bursts of activity leading to adaptability, learning to overcome difficulties, and a moderate risk-taking agenda that allows them to disregard obstacles that prevent others from even exploring new possibilities.[17,20]

Many studies have looked at ADHD through the lens of pathognomonic indicators, such as the Millon Clinical Multiaxial Indicator or the Minnesota Multiphasic Personality Inventory II.[21,22] ADHD often is associated with depression, anxiety, and lower self-esteem as expressions of increased difficulties at home and in the educational setting.[3,8,22,23] Fewer studies have sought to identify the positive aspects of ADHD as capable of influencing adaptive functioning in certain situations and as a precursor to success rather than a pathway to failure. For example, adults with ADHD are nearly four times as likely to be entrepreneurs as their counterparts without the disorder.[18]

In response to increasing interest in understanding individual personality differences, Carl Jung's theory of psychological type has been used to develop tools to identify personality indicators.[24] The essence of the theory is that perceived random variation in human behavior is orderly and consistent, being due to certain basic differences in the way people prefer to use their perception and judgment.[25] The Myers-Briggs Type Indicator (MBTI) was the first tool developed to investigate Jung's ideas and measures preferences of the four polar dimensions: Extraversion/Introversion, Sensing/Intuiting, Thinking/Feeling, and Judging/Perceiving. According to type theory, all eight of these preferences are used by each of us but they are not preferred equally. The Murphy-Meisgeier Type Indicator (MMTIC) was developed in an attempt to expand such investigation into the lives of children. The MMTIC reflects normal and adaptive development without any reflection of pathology.[26] As each individual grows and develops, predisposed preferences emerge regarding how that person will operate and transact in the world. To date there has been little research looking into the relationship between individual personality type in populations of children with ADHD.

The current version of MMTIC has been constructed carefully and the combined reliability and validity statistics demonstrate it is appropriate for and accurately assesses preferences for grades 2 thru 12.[26] One particular value of the MMTIC is that it demonstrates clear expectancies of type for the general population. For example, approximately 54% of children would be Judging in their orientation to the world and approximately 46% would be Perceiving. Judging children tend to be planful, organized, orderly, and systematic, whereas Perceiving children tend to be creative, curious, open, flexible, and adaptive, but somewhat scattered in terms of organization. Likewise, expectancies for Sensing and Intuiting would be 57% and 43%, respectively. Sensing children archetypally are present-centered observers who like to do things now, one step at a time, paying attention to details with little regard for the future. Alternatively, Intuiting children tend to look to the future seeking patterns and relationships with a focus on the big picture but often missing details.

The primary research goal was to determine the extent to which an ADHD diagnosis is associated with certain personality preferences. This research explored the possibility that ADHD carries a predisposition to experience the world in certain ways that may complicate the delivery of treatment services and the way in which children with ADHD actually use treatment services. Given the aforementioned descriptions of these personality types, we proposed that Sensing/Perceiving children would not be a natural fit for some educational settings. In addition, their individual preferences may predispose them to be identified as having ADHD. We hypothesized that children with ADHD would be more likely to express the Sensing and Perceiving dimensions on the MMTIC. The Extraversion/Introversion or Thinking/Feeling dimensions were not expected to differ from established population frequencies.

METHODS

Patients between grade levels 2 and 12 presenting to the practicing psychologist at a general pediatrics clinic in Wichita, KS, who previously were diagnosed with ADHD (all types), were asked to participate in this study. Recruitment occurred between May 2011 and March 2015. For this study, ADHD was defined as confirmed diagnosis by a pediatrician and required additional documentation utilizing the Conner's Behavior Rating Forms, both Parent and Teacher.[27,28]

Age, grade level, and gender were collected for all enrolled participants. Each participant was asked to complete the MMTIC. The 43-item assessment tool has documented reliability between .69 and .78 for each of the four scales (Extraversion/Introversion, Sensing/Intuiting, Thinking/Feeling and Judging/Perceiving).[26] Children completed the instrument using a computerized assessment (Center for Applications of Psychological Type, Inc; www.capt.org). Basic frequencies were calculated for each of the four dimensions as well as the combinations of all four dimensions. Observed frequencies of individual types were compared to expected values taken from the MMTIC Manual.[26]

Given the small sample size and skewed distribution of age and grade level, non-parametric tests were used. Age and gender of respondents for each dimension were compared using Mann-Whitney U and Fisher's exact tests, respectively. Frequencies of MMTIC preferences were compared to expected values using binomial test of proportion. Analyses were performed using SPSS (IBM SPSS Version 20.0). Significance was defined as $p < 0.05$. T-test and chi-squared tests were two-tailed. The binomial test of proportion is a one-tailed test. This project was approved by the institutional review board at the Wichita Medical Research and Education Foundation.

RESULTS

All children with a verified diagnosis of ADHD seen by the psychologist were enrolled (n = 117). Children were mostly male (78%), with a median age of 10 (interquartile range [IQR] 8 - 12), and were in the 4th grade (IQR 3 - 6). The most common 4-type personality indicator was ISFJ (Table 1). Table 2 describes the percent of each personality type who were male and the median age for each type. Age and gender were significantly associated with trait preferences across dimensions (age unassociated with Feeling/Thinking dimension, $p = 0.074$, all others unassociated, $p > 0.2$).

When compared to expected averages taken from the MMTIC manual, children in our sample were more likely to exhibit the Sensing preference (72%) than would have been expected (57%; $p = 0.001$). No differences were detected in the expression of the Perceiving preference (44%) as compared to the expected 46% ($p = 0.334$). Differences were detected in both the proportion expressing the

Introversion preference (58%; p = 0.001) and the Thinking preference (29%; p = 0.005). Respectively, these are compared to expected frequencies of 43% and 41%.

Table 1. Distribution of personality types.*

ISTJ 5.1%	**ISFJ** 20.5%	**INFJ** 5.1%	**INTJ** 0.9%
ISTP 6%	**ISFP** 13.7%	**INFP** 3.4%	**INTP** 3.4%
ESTP 2.6%	**ESFP** 4.3%	**ENFP** 5.1%	**ENTP** 5.1%
ESTJ 5.1%	**ESFJ** 14.5%	**ENFJ** 4.3%	**ENTJ** 0.9%

*Extraversion/Introversion, Sensing/Intuiting, Thinking/Feeling, and Judging/Perceiving.

Table 2. Age and gender by type.

	% Male	Median Age
Extroversion	73%	10
Introversion	81%	10
Intuiting	76%	10
Sensing	79%	10
Feeling	76%	10
Thinking	82%	10
Perceiving	75%	10
Judging	80%	10

DISCUSSION

The results of this study affirmed our hypothesis that children with ADHD were more likely to be Sensing on the MMTIC, but did not support that they are more likely to exhibit the Perceiving trait. These results presented an intriguing picture of ADHD and personality type that warrants future research, especially at pediatric clinics where ADHD is a relatively common diagnosis. It would be important to see if children with an ADHD diagnosis are indeed more likely to be Sensing in their personality style. Sensing children may live in the present moment without much thinking or worrying about the future and often like real things that are right now. They prefer going step-by-step in a concrete fashion and principally are not interested in theories or big picture generalizations that are usually part of the instructional field of play in any educational system. These children tend to be pragmatic and practical and if the lesson does not make sense to them they will disregard it because the lesson has no place in their worldview. It could be expected that Sensing children would have trouble with an educational system designed to teach big concepts that have little to no real meaning for the practical world they live. Conversely, Intuiting children tend to be quick in their ability to get the major concepts being taught but often miss the details leading to the larger lesson.

The Judging/Perceiving dimension is equally intriguing. Judging children tend to be organized and systematic, while Perceiving children tend to be more curious and playful in their approach to the outside world, including education. Children with a Judging preference may value getting things done and often enjoy schedules and routines. Judgers tend to be neat, orderly, and like completing their work on time. They frequently cannot consider playing if they have an assignment due. Perceiving children tend to be far more flexible and like to have time open to do whatever they want whenever they want to do it. They may start lots of projects but have difficulty actually getting anything done. The importance of the spontaneous moment can be a powerful enticer for the Perceiving child. This is precisely why we expected children with ADHD to be inclined to be more Perceiving in their orientation; however, the data in our sample did not support this hypothesis.

There were other incidental findings in this research regarding higher than expected expression of Introversion and Feeling. It may be that these preferences grew in response to the impairments associated with ADHD, for example, difficulty forming and maintaining friendships or heightened sensitivity to educational impediments. However, further research is necessary.

This research pointed to the importance of knowing who the patient is, just as much as knowing what the patient has. The utilization of the MMTIC afforded the opportunity to do just that and to tailor approaches to intervention to fit the personal style of the child. It also allowed the opportunity to think more globally with parents about why a child does what they do, not just in terms of ADHD, but also in terms of who they are as people. This process also suggested where effort needs to be placed in terms of educational interventions and in treatment especially regarding cognitive behavioral approaches. For example, interventions that require a long-term investment and delayed gratification might not bear as much fruit as those devised in a playful, present centered way, with a reward that is immediate rather than delayed.

Perhaps the more important outcome of this research is the consideration of the personality orientation of the child in addition to a focus on the specific ADHD dimensional criteria. We would suggest that adding the MMTIC to standard ADHD assessment techniques such as behavior rating scales and computer generated tests may create a more complete picture of the child we hope to help.

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Keywords: attention deficit hyperactive disorder, Myers Briggs Type Indicator, personality inventory, pediatrics

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Functional Outcomes of Thoracolumbar Junction Spine Fractures

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ABSTRACT

Introduction. Few studies have evaluated the functional outcomes of traumatic thoracic and lumbar vertebral body fractures. This study evaluated the functional and clinical outcomes of patients, who sustained a fracture to the thoracolumbar area of the spine (T10 to L2 region), with ≥ 25° kyphosis versus those with less kyphotic curvature.

Methods. The trauma registry records of two level 1 trauma centers using ICD-9 codes for fracture to the thoracolumbar juncture (T10 to L2 region) were reviewed. Kyphosis angle was measured on the standing lateral thoracolumbar (T1 - L5) radiograph at initial trauma and at clinical follow-up. Functional outcome questionnaires, including the Oswestry Disability Questionnaire (ODQ), the Roland Morris Disability Questionnaire (RMDQ), and the Nottingham Health Profile (NHP), were evaluated at clinical follow-up. Work status and medication used after trauma also were recorded.

Results. A total of 38 patients met the inclusive criteria. Seventeen patients (45%) had ≥ 25° kyphosis and 21 patients (55%) had < 25° kyphosis at follow-up. These two groups were similar based on sex and age. Based on the ODQ Score, the RMDQ Score, and the NHP, no statistically significant differences were detected between the two groups in regards to energy, pain, mobility, emotional reaction, social isolation, and sleep.

Conclusions. Patients who sustained a fracture to the thoracolumbar area of the spine with ≥ 25° kyphosis do not report worse clinical outcomes. When using the kyphosis angle as an indication for surgery, it should be used with caution and not exclusively. ***KS J Med 2017;10(2):30-34.***

INTRODUCTION

Fractures of thoracic and lumbar spine, especially at the thoracolumbar junction (T10 to L2), often are related to high energy trauma[1], and represent nearly 90% of traumatic spine fractures.[2-5] The thoracolumbar junction represents a transition zone of the spine, and high energy forces, coupled with the local anatomy, contribute to the high incidence of fractures of this region. Despite the fact that this is a common fracture, the treatment of burst and compression fractures remains controversial regarding the ideal management. Previous studies have proposed treatment guidelines such as canal compromise, neurologic deficit, loss of vertebral body height, and kyphosis as relative indications for operative treatment versus non-operative treatment of this type of injury. The advantages of surgery include better correction of kyphotic deformity, greater initial stability, an opportunity to perform direct or indirect decompression of neural elements, decreased requirements for external immobilization, and an earlier return to work.[6-8] In the body of literature concerning the degree of kyphosis that can be accepted or required, surgical correction continues to be questioned.

To address the questions that surround the treatment of acute thoracolumbar fractures, it is important to elucidate the correlation between residual kyphotic deformity and patient's functional outcome. Kraemer et al.[4] performed a retrospective chart review and concluded that patients with kyphosis of greater than 25° were affected more severely and have poorer outcomes. Shen et al.[9] commented the majority of studies have been on patients with less than 30° kyphosis, therefore, it is impossible to comment on these cases having more severe sagittal angulation in regards to outcome. The purpose of this study was to evaluate the functional and clinical outcomes of patients, who sustained a fracture to the thoracolumbar area of the spine (T10 to L2 region), with greater than or equal to 25° of kyphosis versus those with less kyphotic curvature.

METHODS

The trauma registry records of two Midwest Level 1 regional trauma centers for the last 5.5 years using ICD-9 codes (code: 805.2 - 805.5, 806.20 - 806.40, 806.5, 806.60 - 806.79) were reviewed in a prospective cohort study to identify patients with spinal fracture. Both Level 1 regional trauma centers from which the records were obtained served a rural catchment area for a multi-state region. Before commencing, this study protocol and amendments were reviewed and approved by three local Institutional Review Boards (IRB).

The inclusion criteria for this study were for patients between 18 and 65 years of age with burst or compression vertebral body fracture at the thoracolumbar junction. These fractures resulted from a high energy traumatic event such as fall, motor vehicle accident, motorcycle accident, or sporting event accident. Patients with a fracture that was not located on the vertebral body, had neurovascular involvement, osteoporosis, previous spinal fracture, or prior spinal surgery were excluded from this study.

The standing lateral thoracolumbar (T1 - L5) radiograph of potential patients was reviewed (at initial trauma), and was used to measure the amount of kyphosis at the fracture site from the next adjacent intact vertebrae above and below using the Cobb method (Figure 1). This measuring method is similar to one previously reported.[10] Each potential patient was contacted through a recruitment letter or by telephone, and reimbursement for their research-related expenses was offered to recruit participants.

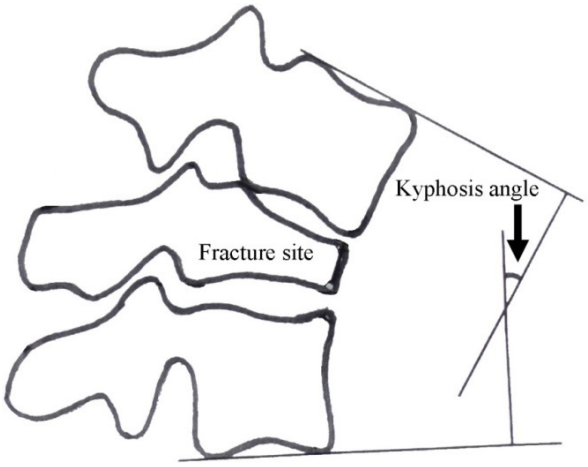

Figure 1. Schematic diagram of kyphosis angle measurement on lateral thoracolumbar radiograph.

A clinical follow-up evaluation (at least four months post-trauma) was performed using standing lateral thoracolumbar radiographs to measure the post-trauma kyphosis angle and functional outcome questionnaires to determine level of disability and general health status. These functional outcome questionnaires included the Oswestry Disability Questionnaire (ODQ), the Roland Morris Disability Questionnaire (RMDQ), and the Nottingham Health Profile (NHP).

Work status and medication use after the trauma also was collected. The ODQ is a time-tested outcome assessment tool that is used to measure a patient's impairment and quality of life. The RMDQ is a self-administered disability measure in which greater levels of disability are reflected by higher numbers on a 24-point scale. The RMDQ yields reliable measurements, which are valid for inferring the level of disability, and sensitive to change over time for groups of patients with low back pain. The NHP is a general patient-reported outcome measure which seeks to measure subjective health status and is a questionnaire designed to measure a patient's view of their own health status in a number of areas in regards to energy, pain, physical mobility, emotional reaction, social isolation, and sleep. These questionnaires are considered the "gold standard" of low back functional outcome measuring tools.[11-13]

STATISTICAL ANALYSIS

Statistical evaluation included the use of the non-parametric Mann-Whitney U statistic using SPSS software (Version 19.0; SPSS Inc., Chicago, IL) to compare those with greater kyphotic measurements versus those with lesser kyphotic measurements. The Chi-square statistic also was used to determine if a distribution of observed frequencies differed from theoretical expected frequencies where the dependent and independent variables were nominal or ordinal measures. The level of significant difference was defined as $p < 0.05$.

RESULTS

A total of 38 patients meeting criteria was comprised of 21 men (55%) and 17 women (45%). Seventeen (45%) of the 38 patients were those with ≥ 25° kyphosis at follow-up, with five of those patients (29%) presenting initially and 12 patients (71%) progressing to an increase in kyphotic measurement at follow-up. There were nine male (53%) and eight female (47%) in this subgroup with mean age of 37 ± 15 years old (range: 18 - 63 years old). Seven patients (41%) of the 17 had a record of open reduction internal fixation (ORIF) surgery at the time of acute hospitalization, with the remainder being treated with conservative therapies prior to hospital dismissal (Table 1).

Twenty-one (55%) of the 38 patients were those with < 25° kyphosis at follow-up, whereas only one of these patients (5%) presented initially with ≥ 25° kyphosis. There were 12 males (57%) and nine females (43%) in this subgroup with mean age of 40 ± 16 years old (range: 18 - 64 years old). Five patients (24%) had a surgery at the time of acute hospitalization (two patients had ORIF and three had kyphoplasty or vertebraplasty) with the remainder 16 patients (76%) selected with conservative therapies prior to hospital dismissal. Table 1 shows a complete demographic summary and descriptive statistics.

Table 1. Demographic summary and descriptive statistics.

Thoracolumbar Juncture Fracture T10 to L2 (n = 38)		Follow-up angle ≥ 25 degrees (n = 17)	Follow-up angle < 25 degrees (n = 21)	p-value
Initial Angle ≥ 25 degrees - Yes/No		5 (29%) / 12 (71%)	1 (5%) / 20 (95%)	0.04*S
Initial Angle (degrees)		21.1 ± 9.4 (range: 7 to 45)	8.0 ± 9.4 (range: -7 to 26)	0.00‡S
Mean Follow-up Angle (degrees)		34.4 ± 7.8 (range: 25 to 47)	10.4 ± 8.3 (range: -5 to 24)	0.00‡S
Gender - Male/Female		9 (53%) / 8 (47%)	12 (57%) / 9 (43%)	0.80*NS
Age at Injury (years)		37.3 ± 15.3 (range: 18 to 63)	40.5 ± 15.7 (range: 18 to 64)	0.47‡NS
Surgical Treatment Type	Kyphoplasty/ Vertebraplasty	0 (0%)	3 (14%)	0.03*S
	ORIF	7 (41%)	2 (10%)	
	No treatment	10 (59%)	16 (76%)	

*Significance testing Chi-square statistic (*NS = not significant / *S = significant, $p < 0.05$)
‡Significance testing Mann-Whitney U statistic (‡NS = not significant / ‡S = significant, $p < 0.05$)

Oswestry Disability Questionnaire (ODQ) Score

The overall ODQ score was calculated as a percent according to standardized methods. The overall mean percent score for the group of 38 patients, who sustained a fracture to the thoracolumbar area of the spine (T10 to L2 region), was 23% ± 17. When stratified by degrees of kyphosis, the ≥ 25° kyphosis group was higher at 27% ± 18 as compared to the < 25° kyphosis group at 20% ± 17. However, no statistically significant difference was detected ($p = 0.17$, Figure 2).

Roland and Morris Disability Questionnaire (RMDQ) Score

The RMDQ score was summed according to standardized methods. The average score was 6.7 ± 6.1. All strata were compared for association with none showing a significant difference in terms of disability (Figure 2). There was a trend, however, in operative patients with < 25° kyphosis group having a significant increase in disability when compared to the same degree of kyphosis non-operative patients.

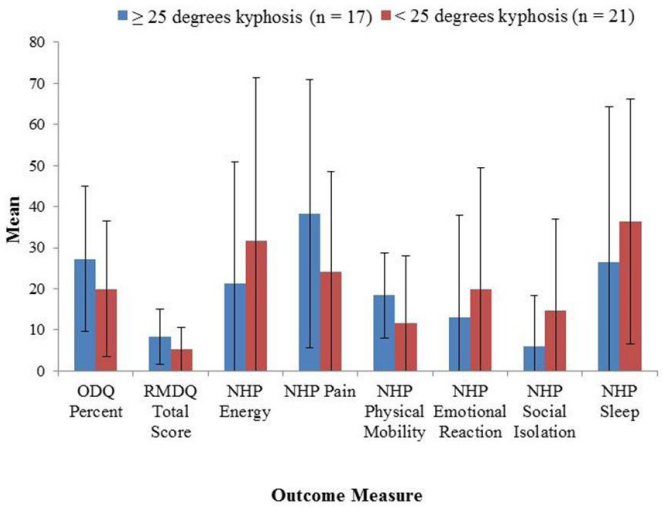

Figure 2. Mean outcome measures stratified by binary follow-up angle measurement with standard deviation.

Nottingham Health Profile (NHP) Score

The NHP score was calculated for the six major domains according to standardized methods, which included weighted scoring. For the overall, the six domains yielded a mean and standard deviation as follows: NHP Energy = 25.7 ± 34.2, NHP Pain = 30.6 ± 28.9, NHP Physical Mobility = 14.9 ± 14.1, NHP Emotional Reaction = 15.8 ± 26.6, NHP Social Isolation = 10.1 ± 18.2, and NHP Sleep = 32.8 ± 34.0. Chi-square statistic testing showed no statistically significant differences except for the NHP Physical Mobility which approached significance (p = 0.05; Figure 2).

Work Status

At final follow-up, 23 patients (61%) of the 38 patients reported returning to their full-time work status, with another six patients (16%) listing part-time employment. Of those patients with ≥ 25° kyphosis at follow-up, one patient (6%) was unable to work due to back pain, and two patients (12%) reported not returning by choice. There was no patient with < 25° kyphosis at follow-up that reported being unable to work after the trauma (Table 2). No significant difference, however, was detected between these two groups.

Table 2. Work status summary.

Thoracolumbar Juncture Fracture T10 to L2 (n = 38)	Follow-up angle ≥ 25 degrees (n = 17)	Follow-up angle < 25 degrees (n = 21)	p-value
Work Full-time	8 (47%)	15 (71%)	0.37*NS
Work Part-time	4 (24%)	2 (10%)	
Seeking Employment	1 (6%)	1 (5%)	
Not working by choice	2 (12%)	3 (14%)	
Unable to work due to back problem	1 (6%)	0 (0%)	
Unable to work NOT due to back problem	1 (6%)	0 (0%)	

*Chi-Square statistic (*NS = not significant / *S = significant p < 0.05)

Medication Used after the Trauma

Of those reporting medication use at follow-up, 17 patients used at least one narcotic for pain (12 patients used hydrocodone/acetaminophen; four patients used oxycodone/acetaminophen; and one patient used codeine/acetaminophen). Two of the 17 patients reported use of different combination types of narcotics: hydrocodone/acetaminophen and oxycodone/acetaminophen in combination and oxycodone/acetaminophen and codeine/acetaminophen in combination. None reported using more than two narcotic drugs in combination.

Nine of the 17 patients reporting narcotic use used anti-inflammatory medications, with one patient taking additional acetaminophen, two patients taking aspirin, five patients taking ibuprofen, and one patient taking celecoxib. There were an additional 11 patients that took only an anti-inflammatory with one patient taking naproxen, four patients taking aspirin, five patients taking ibuprofen, and one patient taking tramadol. Of those only taking an anti-inflammatory, three patients also took a second anti-inflammatory, ibuprofen.

Of those reporting medication use, 10 patients reported taking an antidepressant at the time of the two-year mean follow-up. One patient was taking fluoxetine alone (no other medication), three patients reported taking venlafaxine hydrochloride extended-release along with an anti-inflammatory (alprazolam, ibuprofen, or clorazepate), and six patients reported taking one of five antidepressants along with a narcotic medication (one patient taking quetiapine, one patient taking paxil, two taking fluoxetine, one taking duloxetine, and one taking sertroline). Of the eight reporting use of muscle relaxants, all were in combination with narcotic medications, five with cyclobenzaprine, one with diazepam, one with valium, and one with metaxalone.

DISCUSSION

The decision to treat acute thoracic and lumbar spine fractures, especially at the thoracolumbar junction (T10 to L2), operatively or non-operatively based on kyphotic deformity of the patient, remains controversial. Conservative treatment is usually the method of choice as it was related to lower costs and lower complication rates.[4,14-27] This type of treatment for unstable fractures, however, is associated with high risk of

neurologic deterioration, putting neural elements at risk of injury, and potential development of progressive instability.[14,16,19,26-31] Operative stabilization of the spine is preferred in those patients who need correction of the kyphotic deformity, thereby reducing mechanical back pain and allowing early patient mobilization.[1,6,32-36]

Kyphotic deformity at the thoracolumbar junction has been a more controversial matter as there have been conflicting studies as to the amount of kyphosis leading to poor outcomes and necessitating operative treatment. Gertzbein et al.[37] reported a positive relationship between kyphotic deformities of 30° or more and back pain at both 1- and 2-year follow-up of thoracic and lumbar fractures. In their study, they concluded kyphotic deformity of greater than 30° was associated with an increased incidence of more intense back pain; however, this study did not subdivide the type of fractures. Krompinger et al.[18] stated that if the kyphosis angle was less than 30° and spinal canal narrowing was less than 50% then these could be defined as stable. They reported that 36% of thoracolumbar burst fractures progressed 10° or more at follow-up; however, the remaining residual deformity was not correlated with symptoms at follow-up. Reid et al.[22] concluded that it was necessary to treat patients operatively with burst fractures if these patients have neurologic deficits or a kyphosis angle more than 35°. Shen et al.[4,29] concluded there was a poor correlation between clinical results and kyphosis greater than 30°, and Cantor et al.[15] stated that fractures without neurologic deficit, with kyphosis less than 30° and height loss less than 50%, were defined as stable. The findings of the present study concur with these previous studies that there was no association between the kyphotic deformity ≥ 25° and functional and clinical outcomes of patients.

Several questions and limitations can be raised concerning the outcome of this study. This study was a prospective cohort study, but not randomized. With follow-up period of 2.3 years, the results must be considered short-term outcomes. One other weakness of present study was that a low percentage of the trauma patient population (38 patients) participated, and there were a relatively small number of patients with ≥ 25° of kyphosis deformity. Nevertheless, the numbers of these patients exceed those that have been reported in prior reports. This study also was limited in that there was no standardized conservative treatment that was strictly practiced, thus treatment options could be another possible factor affecting the clinical outcomes.

CONCLUSIONS

The functional and clinical outcomes of patients who sustained a fracture to the thoracolumbar area of the spine (T10 to L2 region) with ≥ 25° of kyphosis were not considerably different from that of those with < 25° of kyphosis. Based on the results of this study, patients who sustained a fracture to the thoracolumbar area of the spine with ≥ 25° of kyphosis do not appear to report worse clinical outcomes. It is advised, however, that when using this criterion as a sole indication for surgery, it should be used with caution and not exclusively. Further investigation of this patient population with functional outcome measures is required to support the conclusion of this study.

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Keywords: spinal fractures, treatment outcomes, kyphosis, kyphotic curvature

KANSAS JOURNAL of MEDICINE

Validation of Different Combination of Three Reversing Half-Hitches Alternating Posts (RHAPs) Effects on Arthroscopic Knot Integrity

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ABSTRACT

Introduction. With arthroscopic techniques being used, the importance of knot tying has been examined. Previous literature has examined the use of reversing half-hitches on alternating posts (RHAPs) on knot security. Separately, there has been research regarding different suture materials commonly used in the operating room. The specific aim of this study was to validate the effect of different stacked half-hitch configuration and different braided suture materials on arthroscopic knot integrity.

Methods. Three different suture materials tied with five different RHAPs in arthroscopic knots were compared. A single load-to-failure test was performed and the mean ultimate clinical failure load was obtained.

Results. Significant knot holding strength improvement was found when one half-hitch was reversed as compared to baseline knot. When two of the half-hitches were reversed, there was a greater improvement with all knots having a mean ultimate clinical failure load greater than 150 newtons (N). Comparison of the suture materials demonstrated a higher mean ultimate clinical failure load when Force Fiber® was used and at least one half-hitch was reversed. Knots tied with either Force Fiber® or Orthocord® showed 0% chance of knot slippage while knots tied with FiberWire® or braided fishing line had about 10 and 30% knot slippage chances, respectively.

Conclusion. A significant effect was observed in regards to both stacked half-hitch configuration and suture materials used on knot loop and knot security. Caution should be used with tying three RHAPs in arthroscopic surgery, particularly with a standard knot pusher and arthroscopic cannulas. The findings of this study indicated the importance of three RHAPs in performing arthroscopic knot tying and provided evidence regarding discrepancies of maximum clinical failure loads observed between orthopaedic surgeons, thereby leading to better surgical outcomes in the future. ***KS J Med 2017;10(2):35-39.***

INTRODUCTION

Rotator cuff tears are common, potentially leading to shoulder pain and dysfunction. During upper extremity movement (especially throwing and swimming), the anterior aspect of the supraspinatus tendon is under the greatest load and commonly is involved in rotator cuff injury.[1] Arthroscopic techniques are used for rotator cuff repairs to minimize invasiveness and pain. During arthroscopic surgery, the surgeon commonly is required to tie a sliding arthroscopic knot followed by a series of reversing half-hitches on alternating posts (RHAPs) in an attempt to yield a knot capable of secure tissue fixation. This fixation also must be provided while working through arthroscopic cannulas and with the use of a knot pusher. At least three RHAPs after placement of most types of sliding or non-sliding knots are necessary for optimal knot integrity.[2-6] Chan et al.[7] described a technique for switching posts simply by alternating tension on the suture limbs, whereby the knot "flips" and the wrapping limb (or the loop limb) effectively becomes the post. However, Meier et al.[8] noted that there is a potential flaw when a ''flipped'' knot is tensioned, past-pointed, or pulled back on by the knot pusher causing the knot to inadvertently revert to its original configuration.

Arthroscopic knot tying requires significant practice and attention to detail, especially in tying the three RHAPs in a knot. A particular technical mistake that has been identified is pulling back the knot pusher either through the arthroscopic cannula or while tying the knot, thereby turning the suture around the post limb and creating unintentional tension applied to the wrapping suture limb. This combination of events "flips" the half-hitch and converts a series of RHAPs into a series of identical half-hitches on the same post, negating the kinking effect created by alternating posts.[8] Half-hitches tied onto the same post will create insecure knots or suture loops with slippage as the most likely failure mechanism. Chan et al.[5] evaluated the relative strength of four different stacked half-hitch configurations: identical half-hitches on the same post, reversing half-hitches on the same post, identical half-hitches on alternating posts, and reversing half-hitches on alternating posts. It was determined that the reversing half-hitches on alternating posts are unlikely to fail by slippage, but rather by rupture of the suture material itself.

Suture materials have an effect on the loop/knot security with arthroscopic knots.[9-14,24] Herculine™ and Ultrabraid® suture material consists of braided, non-absorbable polyethylene fibers without a longitudinal core, something that is present in FiberWire® and Orthocord®. Both Ultrabraid® and Force Fiber® are made with braided UHMWPE with only variations in weaver patterns used. FiberWire® is made of braided polyethylene and polyester fibers coated with a proprietary coating. Orthocord® is made with dyed absorbable polydioxanone core (PDS 68%) with a combination of the undyed, non-absorbable, ultra-high molecular weight polyethylene (UHMWPE 32%) as a sleeve and coated with polyglactin.[15,16] Overall, these sutures are made of similar materials, but with varying designs; thereby different mechanical and handling properties have been reported.

To our knowledge, there has not been a study documenting the effect of different combinations of three stacked half-hitches and suture materials on the loop/knot security of an arthroscopic knot. Testing all combinations systematically would create a large number of possible combinations that would be prohibitively large. It is with this consideration that a reduced number of combinations of three stacked half-hitches were evaluated. The specific aim of this study was to evaluate the effect of different stacked half-hitch configurations and different braided suture materials on an arthroscopic knot's loop and knot security. The hypothesis was that both stacked half-hitch configurations and specific types of braided suture materials have a significant effect on the knot loop and knot security.

Materials and Methods

This study design compared three different suture materials tied with five different stacked RHAPs in arthroscopic knots. The three different types of braided materials consisted of the following: Force Fiber® (Stryker, San Jose, CA), FiberWire® (Arthrex, Naples, FL), and Orthocord® (DePuy-Mitek, Warsaw, IN). All arthroscopy suture materials were #2 braided polyblend polyethylene with an estimated length of 48 cm (19 inch) of each material used for tying all of the knots in order for comparison.

All knots were tied with a standard knot pusher using standard arthroscopic techniques in a dry environment (Figure 1). A load cell was attached to standardize the amount of strength used to tighten the half-hitches. All knot-tying processes in this study began by advancing three identical half-hitches stacked on the same post (base knot) down to a standardized 30 mm circumference post to provide a consistent starting circumference for each knot, as well as replicate the suture loop created during arthroscopic rotator cuff repair. Each suture material was tied with five different stacked knots of three RHAPs with each of these half-hitches tightened manually to at least 45 N using an over-pointing/past-pointing technique. The tightening loads were conformed with the use of a load cell (Protable Electronic Scale, China). The five different stacked RHAPs were as follows: 1) identical half-hitches on the same post (Configuration #1), 2) reversing half-hitch on first RHAPs (Configuration #2), 3) reversing half-hitch on second RHAPs (Configuration #3), 4) reversing half-hitch on third RHAPs (Configuration #4), and 5) reversing half-hitch on first and third RHAPs (Configuration #5; Figure 2). All knots were tied with a knot pusher by the same orthopaedic surgeon. After each knot was tied over the post, the knotted suture loop was removed and trimmed, leaving approximately 6 mm length tags from the most distal end of the knot. Ten knots with each combination of stacked RHAPs knot configuration and each suture material were tied.

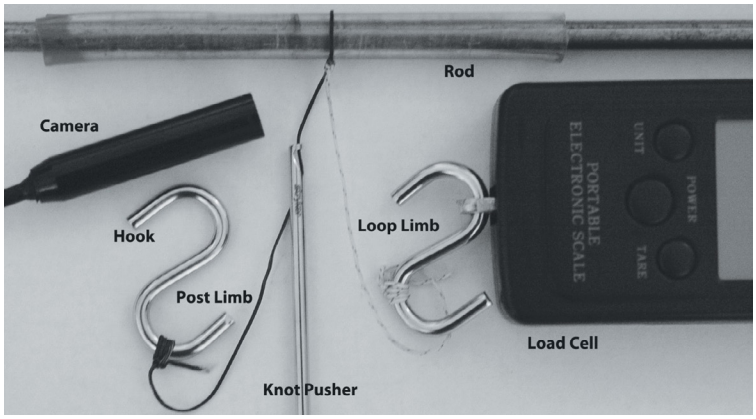

Figure 1. Experimental setup.

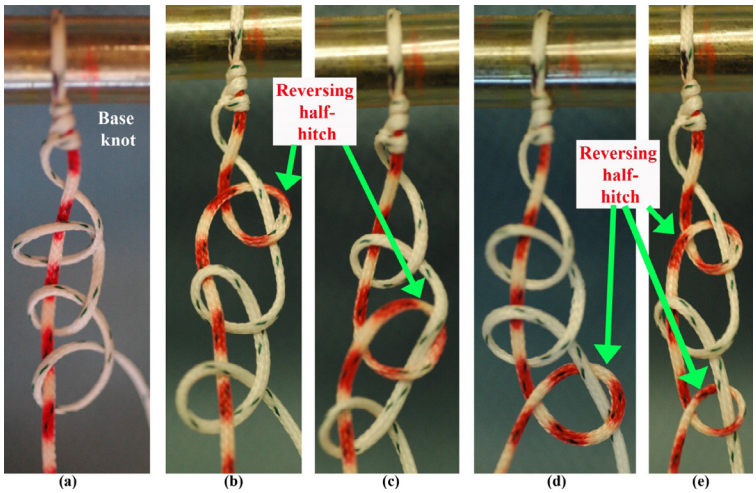

Figure 2. Five different stacked three reversing half-hitches on alternating posts (RHAPs) evaluated: (a) configuration #1: identical half-hitches on the same post; (b) configuration #2: reversing half-hitch on 1st RHAPs; (c) configuration #3: reversing half-hitch on 2nd RHAPs; (d) configuration #4: reversing half-hitch on 3rd RHAPs; (e) configuration #5: reversing half-hitch on 1st and 3rd RHAPs.

Servohydraulic Material Testing System instruments (MTS model 810, Eden Prairie, MN) were used to test the knot and loop security of each combination of knots and suture types. Two round hooks with a diameter of 3.9 mm were attached to the actuator and the load cell (Figure 3a). Loops were preloaded to 6 N to avoid potential errors produced from slack in the loops and stretching of the suture materials, as well as providing a well-defined starting point for data recording. The distance between the two rods was measured (cross-head displacement) and the circumference of the loop was calculated according to the formula as:

$$CL = (2 * L) + (4 * r) + Cr \qquad \text{Eqn 1}$$

The equation variables are: CL is loop circumference, L is cross-head displacement, r is rod radius, and Cr is rod circumference (Figure 3b).

A single load-to-failure test was performed similar to previously described protocols.[2,3,13,14,17-19] Each suture loop was initiated with five preconditioning loading cycles from 6 N to 30 N at 1 Hz. The load was applied continuously at a cross-head speed of 1 mm/sec until complete structure failure. Three millimeters is the point where tissue apposition is lost.[12,20-22]

Based on this criterion, the current study defined knot slippage of 3 mm (crosshead displacement) as "clinical failure" which is supported by previously performed evaluations of different suture/knot combinations.[2-5,13-15,17-19] Load and displacement data were collected at 100 Hz and knot failure mode also was recorded.

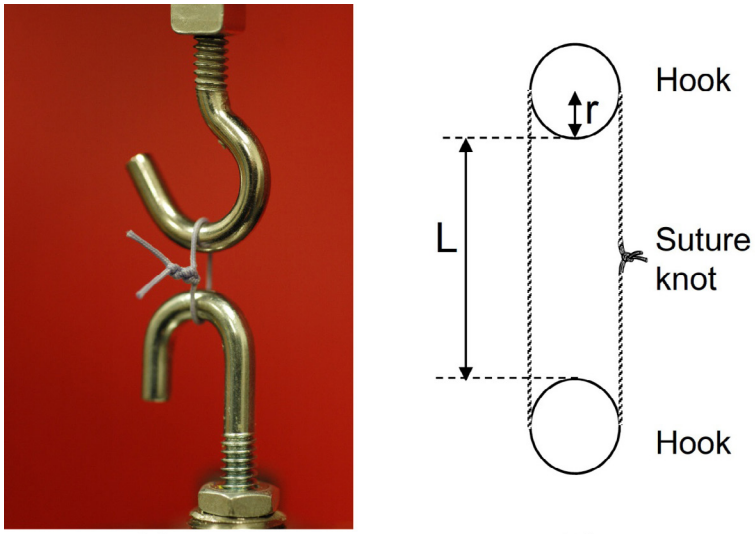

Figure 3. Load-to-failure experimental setup: (a) experimental setup and (b) cross-head displacement measurement.

STATISTICAL ANALYSIS

Data retrieved from the load-to-failure tests were analyzed for any differences among sutures, as well as stacked three RHAPs knot configurations using one-way analysis of variance (ANOVA) with the Least Significant Difference (LSD) multiple comparisons post hoc test method in SPSS software (Version 19.0; SPSS, Chicago, IL) with $p < 0.05$ denoting significant. These analyses were used to determine the statistical relevance of the difference between knot failure load, knot slippage for each suture type, and knot slippage for each knot type. The mean and standard deviation of the ultimate clinical failure load were calculated for each configuration and each type of suture.

RESULTS

Figure 4 shows the mean ultimate clinical failure load (3 mm cross head displacement) of the three different suture materials with five different stacked three reversing half-hitches on alternating posts. In comparison to the base knot (consisting of three identical half-hitches stacked on the same post), knots tied with additional three identical half-hitches stacked on the same post (Configuration #1) using Orthocord® did not show any significant improvement in terms of ultimate clinical failure load ($p > 0.05$). To the contrary, knots tied with this configuration using Force Fiber® or FiberWire® showed improvement (Force Fiber®: 149%; FiberWire®: 84%) compared to the base knot, but with an ultimate clinical failure load still less than 100 N. This is critical as 100 N is the estimated minimum required ultimate load per suture during a maximum muscle contraction.[23]

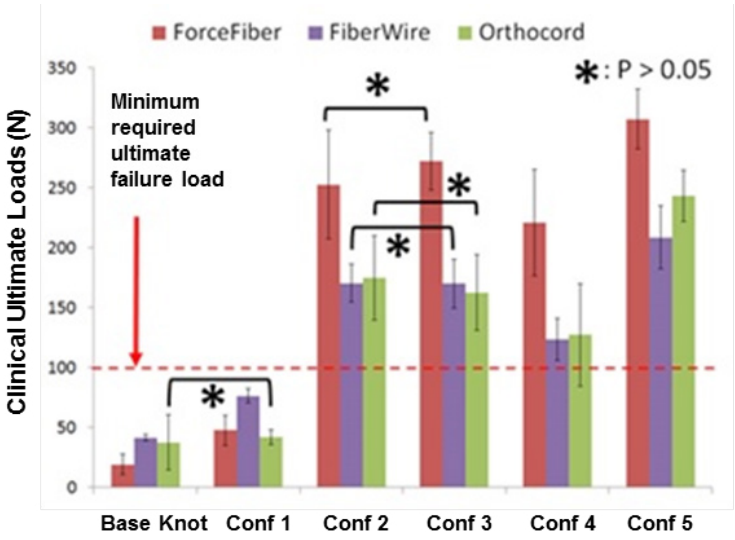

Figure 4. Mean ultimate clinical failure load (3 mm displacement) of sliding knots tied with five different stacked three reversing half-hitches on alternating posts for three different braided materials.

With one of the half-hitches in the RHAPs reversed (Configurations #2 and #3), the mean ultimate clinical failure results showed that there was a significant improvement in knot holding strength compared to Configuration #1 (Force Fiber®: 452%, FiberWire®: 123%, and Orthocord®: 300%), and all knots measured greater than the 100 N failure strength. There were no significant differences detected for knots tied when compared between Force Fiber®, Fiberwire®, and Orthocord® ($p > 0.05$). A significant decrease in strength was detected when Configuration #4, where the last half-hitches of the RHAPs were reversed, was compared to Configurations #2 and #3 (Force Fiber®: 16%, FiberWire®: 28%, Orthocord®: 24%).

With two of the half-hitches of the RHAPs reversed (Configurations #5), this knot configuration had a significant improvement in failure strength when compared to Configuration #1 (Force Fiber®: 543%, FiberWire®: 173%, and Orthocord®: 476%). In addition, all knots measured greater than 150 N of mean ultimate clinical failure load. A knot tied with this configuration had improved failure strength significantly when compared to single reversed half-hitches of the RHAPs. This was seen when compared to Configuration #2 (Force Fiber®: 22%, FiberWire®: 22%, and Orthocord®: 39%), Configuration #3 (Force Fiber®: 13%, FiberWire®: 23%, and Orthocord®: 50%), and Configuration #4 (Force Fiber®: 39%, FiberWire®: 69%, and Orthocord®: 91%).

When comparing suture materials, it is observed that for knots tied with at least one half-hitches of the RHAPs reversed, Force Fiber® suture material had a higher mean ultimate clinical failure load than those knots tied with other suture materials ($p < 0.05$).

Figure 5 shows knot slippage percentage of the knots tied with five different stacked three reversing half-hitches on alternating posts for the three different braided materials. Knots tied with identical half-hitches on the same post (Configurations #1 and #2) resulted in 100% knot slippage.

When one of the half-hitches of the RHAPs were reversed (Configurations #2 - 4), there was less chance of knot slippage compared to Configuration #1 (Force Fiber®: 30 - 60%, FiberWire®: 90 - 100%, and Orthocord®: 60 - 80%). The results showed a significant reduction in knot slippage ($p < 0.05$) when two of the half-hitches of the RHAPs were reversed (Configurations #5). Knots tied with either Force Fiber® or Orthocord® showed no chances of knot slippage, while knots tied with Fiberwire® had about 10% knot slippage.

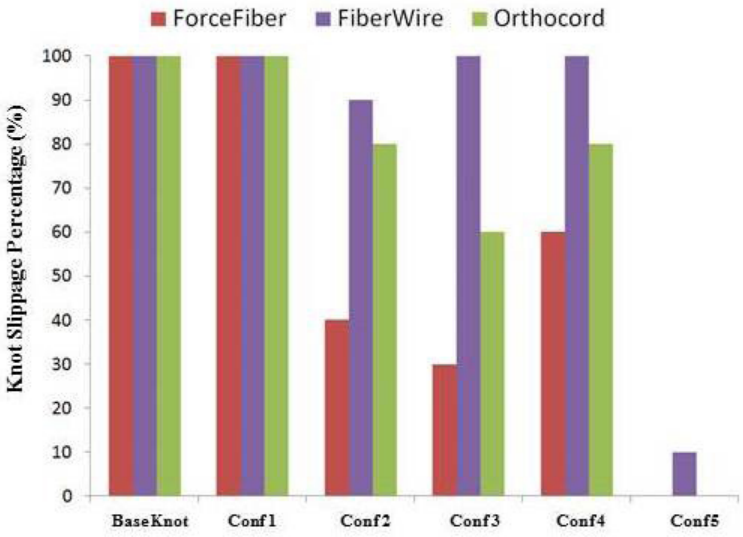

Figure 5. Percentage of knot slippage of knots tied with five different stacked three reversing half-hitches on alternating posts for three different braided materials.

DISCUSSION

The results of this study supported our hypothesis that both stacked half-hitch configurations and braided suture materials have a significant effect on the knot loop and knot security. Switching the post limb between throws in a series of half-hitches has increased the knot security by increasing the friction and the internal interference.[2,3,5] However, while tying the three RHAPs in a knot, technical errors can occur, such as pulling back the knot pusher while tying the knot or turning the suture around the post limb resulting in an unintentional tension applied to the wrapping limb. These errors can reverse the kinking effect created by alternating posts and result in the incorrect three RHAPs configuration. Errors that occur while attempting to create Configuration #5 can lead to a situation more similar to Configuration #2 or #3. This study was undertaken to determine the effect of three half-hitches of the RHAPs placed after a base knot. The mean ultimate clinical failure strength could be reduced by at least 13% (mean: 40 ± 24%, range: 13% - 91%) if one of the half-hitches was unintentionally "flipped".

Optimization of knot security for any given knot configuration, suture material, and surgeon experience level during arthroscopic knot tying is crucial.[5,12,15-17,23-27] Arthroscopic knot tying requires significant practice and attention to detail especially in tying the three RHAPs in a knot. Therefore, training of arthroscopic knot tying by practicing in a "dry-lab" is recommended. In this study, even with using a load cell to standardize the tightening loads onto each half-hitch, there was an average of 22 N (range: 3 - 45 N) of standard deviation.

Braided non-absorbable polyblend sutures commonly used for arthroscopic knots have better strength profiles and less slippage potential.[2,3,15,17,28-31] These studies have evaluated different arthroscopic sliding knot configurations with different suture materials and concluded that a surgeon choosing arthroscopic repair techniques should be aware of the differences in suture material and the variation in knot strength afforded by different knot configurations, as suture material is one of the important aspects of loop security. Our findings are in agreement. Suture materials have a major effect on knot security, especially on a series of three RHAPs, as in theory, these RHAPs should minimize suture friction, internal interference, and slack between loops of the knot, which emphasizes the effect of material selection. Furthermore, our findings also agree with a previous study[14] that suture materials that have a core in the design (Orthocord®, Fiberwire®) tend to have the lower ultimate clinical failure strength and higher prevalence of knot slippage compared to the Force Fiber®. We suspect that one of the important factors affecting the tendency of knot slippage could be the suture surface characteristics and suture construction.

Our experimental design had certain limitations. First, tying a knot on a standardized rigid smooth aluminum post (30 mm in circumference) differed from what is performed clinically. This setup did not account for the variability seen in clinical practice, especially as the suture loop did not pass through any soft tissue, turn acute angles, risk abrasion on suture anchors, or rub over bony surfaces. Second, the metal hooks used in this study were not compressible and did not interpose in the substance of the knot as soft tissue does in the clinical setting. Third, knots were tied with no tension against the sutures, whereas clinical knots are tied under tension as tissues are pulled together in reconstructions. Fourth, there was no blinding of knot type, and there was no randomization of tying order or testing order. Fifth, only a single load-to-failure test was performed and incremental cyclic loading could be more useful, as it has long been recognized as a leading source of failure in orthopedic repairs. Sixth, all arthroscopic knots were tied with a single knot pusher, whereas in the clinical setting different techniques (e.g., cannula) may result in knots that are not exactly similar to those in the laboratory setting. Seventh, the current study was performed in a dry environment, whereas a fluid environment with varying temperature could affect the effectiveness of knots.

CONCLUSIONS

A significant effect was observed for both stacked half-hitch configuration and suture materials on the knot loop and knot security. Caution should be used when tying the three RHAPs in a knot using standard arthroscopic

techniques, a standard knot pusher, and an arthroscopic cannula. This study may provide a solution which potentially could improve the maximum failure loads observed between orthopaedic surgeons, and thereby, achieve better clinical outcomes.

CONFLICT OF INTEREST STATEMENT

The authors received suture materials from Stryker (San Jose, CA) and DePuy-Mitek (Warsaw, IN) for use in this study. However, both Stryker and DePuy-Mitek had no role in the collection, analysis, and interpretation of data, writing of the manuscript, or decision to submit the manuscript for publication. The authors also did not receive any payments or other personal benefits or a commitment or agreements that were related in any way to the research conducted.

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The authors wish to thank Stryker (San Jose, CA) and DePuy-Mitek (Warsaw, IN) who provided the suture materials used in this study. The authors also wish to thank Pie Pichetsurnthorn for her technical support. The authors report no actual or potential conflict of interest in relation to this article.

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Keywords: arthroscopy, suture techniques, orthopedics

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A Preliminary Study of the Attitudes and Barriers of Family Physicians to Prescribing HIV Preexposure Prophylaxis

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ABSTRACT

Introduction. Attitudes of individuals who provide HIV care towards prescribing Preexposure Prophylaxis (PrEP) to at-risk populations have been studied, but few studies indicate if family physicians would be willing to prescribe PrEP as most family physicians do not specialize in HIV medicine. Few data exist on the perceived barriers preventing family physicians from prescribing PrEP. The purpose of this project was to assess the attitudes and perceived barriers of family physicians in Kansas towards prescribing PrEP to high risk patient populations.

Methods. This study was a descriptive, observational, and cross-sectional survey of family physicians who respond to email surveys issued through the Family Medicine Research and Data Information Office (FM RADIO).

Results. Fifty-three percent of family physicians take a sexual history on new patients less than frequently, and only 35% frequently ask about the use of safe sex practices. Only 29% frequently ask if the patient has sex with men, women, or both. Seventy-six percent of respondents would be willing to prescribe PrEP to men who have sex with men, and an equal percentage would be willing to prescribe to heterosexually active men and women who are at substantial risk of acquiring HIV. While 59% of participants agreed that PrEP belongs in the primary care domain of treatment, 71% agreed that they had limited or no knowledge of PrEP guidelines.

Conclusions. This preliminary study indicated a need for increased family physician screening of new patients for high risk sexual behaviors who would be eligible for PrEP. The limited knowledge of PrEP guidelines and its use in clinical practice are significant limiting factors to increasing prescribing practices in the family medicine community rather than a perceived ethical dilemma of prescribing PrEP to men who have sex with men. As a result, an increase in continuing medical education about PrEP could significantly increase its prescribing in the family medicine community. ***KS J Med 2017;10(2):40-42.***

INTRODUCTION

Over 1.2 million people live with HIV in the United States, with 50,000 new infections diagnosed each year.[1,2] The US Centers for Disease Control and Prevention (CDC) projects the lifetime risk of acquiring HIV nationally at 1 in 99.[3] It is projected that 1 in 6 men who have sex with men (MSM) will acquire HIV in their lifetime, which is over 70 times the lifetime risk of heterosexual men. The lifetime risk is highest in African American men who have sex with men (at nearly one in two) and lowest in in white men who have sex with men (one in eleven). In 2014, the CDC recommended the use of Truvada® (tenofovir disoproxil fumarate and emtricitabine) as a method to prevent HIV transmission for three patient populations if they have a substantial risk of acquiring HIV: men who have sex with men, IV drug users, and heterosexually active couples.[4]

HIV specialists noted that patients are more likely to seek care from a primary care physician to start PrEP therapy; thus PrEP may be managed more appropriately by primary care physicians.[5] We assessed if family physicians routinely screen for high risk sexual behaviors and if there are physician biases towards prescribing PrEP for MSM that prevent moving this preventative therapy into the family physician's domain of treatment.

METHODS

The study protocol was approved by the Institutional Review Board at the University of Kansas School of Medicine-Wichita. A confidential email survey was sent to the 85 members of a practice-based research network of family physicians in Kansas, the Family Medicine Research and Data Information Office (known as FM RADIO). The survey was sent with two follow-up emails for non-responders. Surveys were sent via SurveyMonkey® which provided a link to an online survey and allowed for an anonymous response.

RESULTS

The response rate was 20 (23.5%). Sixteen respondents identified their sex; eleven (69%) were males. The average age of the respondents was 55 years with a range of 31 to 74 years. Sixteen respondents revealed their practice county. Seven respondents practiced in a rural county (44%), six practiced in an urban county (38%), and three practiced in counties with a mid-sized regional community (19%).

Respondents revealed they were not familiar with the CDC Preexposure Prophylaxis (PrEP) for the Prevention of HIV practice guidelines.[4] Of 18 respondents, only one (6%) was extremely familiar and seven (39%) were not familiar at all. Two of eighteen respondents (11%) had prescribed the recommended PrEP therapy and HIV antiretroviral medication Truvada®.

Table 1 reveals the respondents' practices in taking a sexual history. As shown, few always take a sexual history on new patients. Few always ask important sexual history questions. Table 2 reveals survey responses related to the willingness to prescribe PrEP in certain patient populations. Most family physician respondents were willing to prescribe PrEP to their patients. Table 3 reveals barriers in prescribing PrEP therapy.

Table 1. Selected responses to survey items related to sexual history practices (n, %).

Survey Item	Never	Rarely	Sometimes	Frequently	Always
I take a sexual history on all new patients (n = 19)	0 (0%)	4 (21%)	6 (32%)	6 (32%)	3 (16%)
I ask about the patient's use of safe sex practices (n = 18).	1 (6%)	6 (33%)	5 (28%)	5 (28%)	1 (6%)
I ask if the patient has had multiple sexual partners in the last 6 months (n = 18)	1 (6%)	7 (39%)	5 (28%)	4 (22%)	1 (6%)
I ask if the patient has sex with men, women, or both.	2 (11%)	7 (39%)	4 (22%)	3 (17%)	2 (11%)

Table 2. Respondents willingness to prescribe PrEP in certain patient populations (n, %).

I would be willing to prescribe Truvada® for HIV Preexposure Prophylaxis (PrEP) to the following patient population(s) if there are no contraindications (n = 17):					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Sexually active adult men who have sex with men (MSM) who are at substantial risk of HIV acquisition	8 (47%)	5 (29%)	2 (12%)	0 (0%)	2 (12%)
Heterosexually active men and women at substantial risk of HIV acquisition	8 (47%)	5 (29%)	2 (12%)	0 (0%)	2 (12%)
Heterosexually active men and women whose partners have HIV infections to protect the uninfected partner during conception and pregnancy	10 (59%)	3 (18%)	3 (18%)	0 (0%)	1 (6%)

Table 3. Barriers to prescribing PrEP therapy (n, %).

Barrier	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Limited or no knowledge of PrEP guidelines (n = 17)	8 (47%)	4 (24%)	4 (24%)	1 (6%)	0 (0%)
Concerned about side effects of Truvada as a prophylactic medication (n = 17)	1 (6%)	3 (18%)	11 (65%)	2 (12%)	0 (0%)
PreP therapy could increase the likelihood of sexually transmitted infections among men who have sex with men (n = 17)	1 (6%)	1 (6%)	7 (41%)	6 (35%)	2 (12%)
Patient adherence and compliance issues with PrEP will decrease its efficacy (n = 17)	0 (0%)	5 (29%)	8 (47%)	3 (18%)	1 (6%)
Prescribing will increase high risk sexual behaviors among men who have sex with men (n = 17)	1 (6%)	1 (6%)	5 (29%)	7 (41%)	3 (18%)
Will decrease safe sex practices among men who have sex with men (n = 17)	1 (6%)	3 (18%)	4 (24%)	8 (47%)	1 (6%)
Stigma or backlash in the office	1 (6%)	0 (0%)	3 (18%)	11 (65%)	2 (12%)
Limited time or resources for patient education about PrEP therapy (n = 17)	1 (6%)	6 (35%)	8 (47%)	2 (12%)	0 (0%)
Do not want to prescribe a medication that requires lab work and follow-up every 3 months (n = 17)	0 (0%)	3 (18%)	9 (53%)	4 (24%)	1 (6%)
Perceived moral and/or ethical dilemma prescribing PrEP to men who have sex with men (n = 16)	0 (0%)	2 (13%)	3 (19%)	8 (50%)	3 (19%)

Eleven of eighteen respondents (61%) agreed that PrEP belongs in the primary care domain of treatment. Only four (22%) agreed that PrEP belongs only in the HIV specialist's domain. Eighty-two percent stated they would be willing to prescribe PrEP with more education and training. Ten of 17 respondents (59%) agreed that PrEP should be covered by private insurance.

Table 4 reveals the conditions when family physician respondents would be willing to prescribe PrEP. Most respondents (70%) would be willing with PrEP education and training.

Table 4. Conditions when respondents would be willing to prescribe PrEP (n = 20).

Condition	n (%)
I received PrEP education and training	14 (70%)
PrEP is covered by private insurance	5 (25%)
I know other family physicians prescribe PrEP	7 (35%)
I did not have to prescribe it to men who have sex with men	1 (5%)
I read research that demonstrates its efficacy in HIV prevention	7 (35%)
Under no circumstances would I prescribe PrEP therapy	1 (5%)

DISCUSSION

This preliminary study indicated a need for increased family physician screening of new patients for high risk sexual behaviors who would be eligible for PrEP. In our sample, no apparent bias was noted against prescribing PrEP for men who have sex with men, as survey participants were equally willing to prescribe Truvada® to MSM and heterosexual couples at high risk for acquiring HIV. Based on the study results, the limited knowledge of PrEP guidelines and their use in clinical practice are significant limiting factors to increasing prescribing practices in the family medicine community rather than a perceived ethical dilemma of prescribing Truvada® to men who have sex with men. Yet, it is difficult to assess the "true" willingness for family physicians to prescribe a medication that a significant number are unfamiliar with. As a result, an increase in continuing medical education about Truvada® could increase its prescribing in the family medicine community.

The strengths of the study include a mixture of both urban and rural participants in communities with varying populations. The small sample size may be due to the controversial nature of the topic which may have shifted the responses towards a more positive side if those who disagreed abstained from the survey, thereby, reflecting a potential sampling bias.

Even with only two study participants not willing to prescribe PrEP, this could be significant in rural areas as there are few primary care physicians available. There is an estimated 3,333 individuals living with HIV in Kansas as of December 2013, which is likely lower than other geographic regions in the United States and could limit physician exposure to HIV management and education on the topic.[6] Further, the lack of awareness of PrEP guidelines as shown by the survey responses may have decreased participation in a cohort known to respond to survey requests.

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CASE REPORT

Pulmonary Embolism after Arthroscopic Bankart and Rotator Cuff Repair

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INTRODUCTION

Pulmonary embolism (PE) is a blockage in one of the pulmonary arteries in the lungs. Since PE almost always occurs in conjunction with deep vein thrombosis (DVT), these two conditions together refer as venous thromboembolism (VTE). PE after shoulder arthroscopy is unusual and rare (reported incidence rate: 0.01 - 0.06%)[1-3], but potentially life threatening.[4] All patients with PE have a case fatality rate of 7 - 11%.[5] In the body of literature, there were less than 50 reported cases of DVT and PE after shoulder arthroscopy.[1-3, 6-26] The majority involved patients with a significant risk factor or underlying predisposition toward VTE.[23] This case report presents a patient with inflammatory bowel disease who developed a symptomatic PE involving the medial segment of the right middle lobe of lung after arthroscopic Bankart and rotator cuff repair following a traumatic shoulder dislocation.

CASE REPORT

A 55-year-old, right-hand dominant, male (body mass index: 30.5 kg/m2) presented with right shoulder pain and weakness with overhead activities. He had an anterior dislocation during a fall one week prior. At the time of injury, he only had shoulder dislocation without any other injuries; therefore, he underwent a reduction and was placed in a sling at a local emergency room with limited ambulation. Radiographic images showed a fracture in the glenoid; a computed tomography (CT) of the shoulder also was obtained. The patient had a history of ulcerative colitis and Grave's disease.

On physical examination, the patient's right shoulder revealed pseudoparalysis with 3/5 supraspinatus strength. He was neurologically intact and stable with a normal apprehension test. Magnetic resonance imaging (MRI) and CT scan results showed a large full-thickness tear of the supraspinatus (Figure 1) and a small bony Bankart lesion on the anterior/inferior edge of the glenoid (Figure 2). It was recommended to repair the Bankart lesion and the rotator cuff arthroscopically.

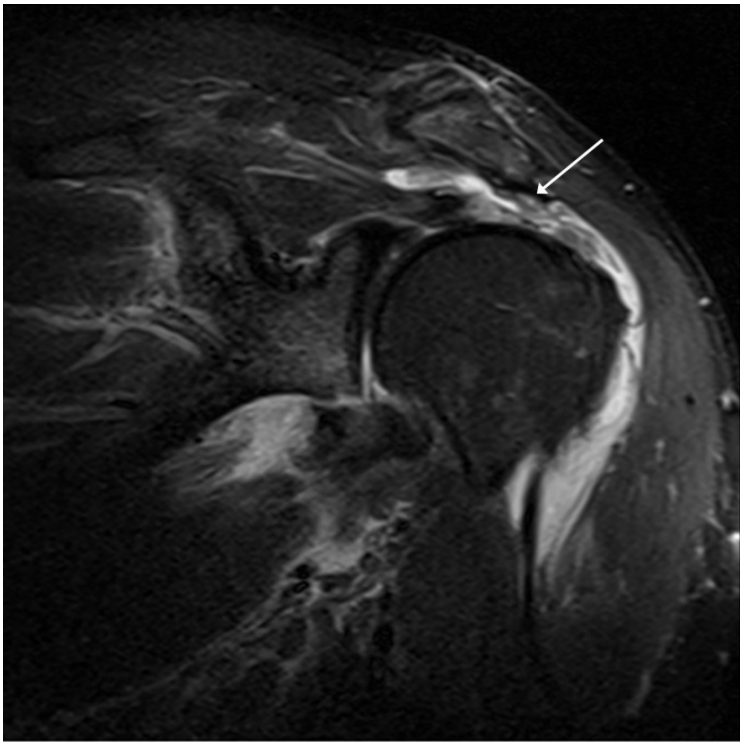

Figure 1. Magnetic resonance imaging (MRI) showed large retracted supraspinatus tendon avulsion following traumatic dislocation.

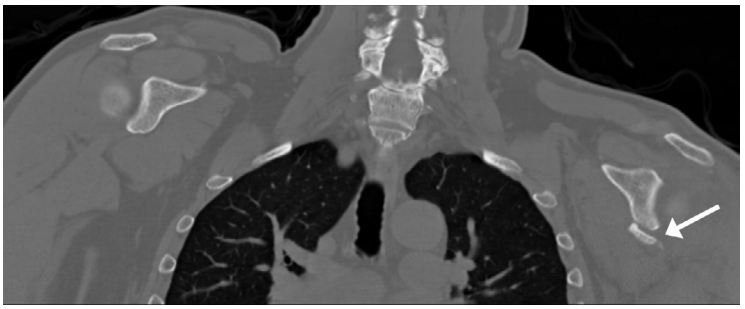

Figure 2. Computer tomography scan showed small anterior/inferior glenoid rim fracture (bony Bankart Lesion).

An interscalene nerve block was performed prior to the surgery. No preoperative DVT chemoprophylaxis was administered. During the procedure, the patient was positioned in the lateral decubitus position and held in place with a beanbag. The operated limb was placed in 20° flexion and 45° abduction. Longitudinal traction was achieved with 4.5 kg (10 lbs) weight to afford the best possible visualization of the joint.

During surgery, the bony Bankart lesion was spotted (Figure 3a) and repair was performed. The operating surgeon attempted to incorporate the bony fragment by using suture anchors where the anchors fixed to the glenoid. There were difficulties, however, in navigating the suture passer around the piece of bone fragment. Due to the difficulty with the Bony Bankart repair, the surgery was longer than expected (total operative time: 3 hours and 15 minutes). Additionally, Sequential Compression Devices are not used routinely during shoulder arthroscopy at our institution.

As a result, a soft tissue Bankart repair was performed (Figure 3b). Following the Bankart lesion repair, the rotator cuff was addressed. A large tear of the supraspinatus was found and repaired using a suture-bridge double-row technique.

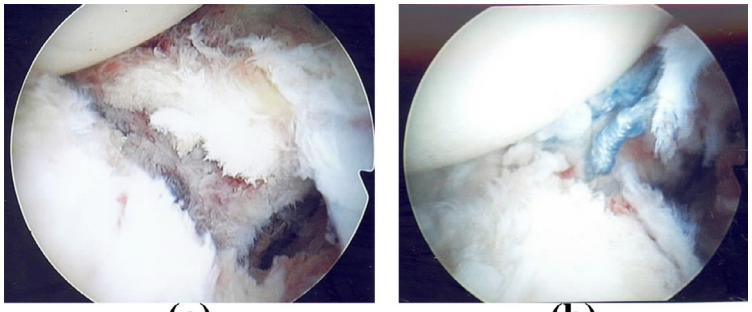

Figure 3. Intra-articular view of small bony Bankart lesion during surgery: (a) injury of the anterior glenoid labrum; (b) repaired Bankart lesion.

After surgery, the affected right shoulder was immobilized in adduction and internal rotation, and the patient returned to most activities that did not include the use of his right shoulder. On post-operative day 4, the patient reported with shortness of breath, tachypnea, and tachycardia which began the night before. The patient, however, claimed no extremity pain or swelling and denied chest pain. A cardiac workup was performed and the results were normal; however, a D-dimer test was elevated. A CT angiogram showed a PE involving the medial segment of the right middle lobe of lung (Figure 4). A Doppler ultrasound test of all four extremities also was performed and the results were negative for DVT.

The patient was placed on the anticoagulation medications, enoxaparin and warfarin. His symptoms improved rapidly and he was discharged home four days later in good condition on warfarin therapy. At the two-week follow-up, he reported excellent satisfaction with the fixation. His pain was minimal and he was able to perform overhead activities. No further workup for thrombophilia was undertaken.

DISCUSSION

PE is an exceptionally rare yet serious complication after arthroscopic shoulder surgery.[1,12] The exact incidence is unknown and only found in either case reports or small case series.[1-3,7 8 10,11-21,23,24] Burkhart et al.[26] was the first to report a case of a 32-year-old man who developed DVT in 1990 following shoulder arthroscopy, and Kim et al.[15] was the first to report a case of a 45-year-old woman who developed a fatal PE in the contralateral axillary vein thrombosis after elective arthroscopic rotator cuff repair in 2010. Goldhober et al.[8] presented a unique case of a 43-year-old female who developed a PE 41 days after repair of the rotator cuff, a distal clavicle excision, and a miniopen subpectoralis long head biceps tenodesis. Yamamoto et al.[3] reported a 72-year-old female patient who developed a PE six days after arthroscopic rotator cuff repair.

Figure 4. CT angiogram showed a PE involving the medial segment of the right middle lobe of lung.

Durant et al.[7] performed a retrospective review of a single, fellowship trained orthopaedic surgeon for ten consecutive years and identified five cases of PE after arthroscopic rotator cuff repair, two of which were fatal. In that study, there were three females and two males with mean age of 61.4 years (range: 54 – 67 years) and the average time to diagnosis of a PE event following surgery was 6.8 days postoperatively (range: 3 - 18 days). Edgar et al.[11] presented three cases of nonfatal PE following elective shoulder arthroscopy: 1) a 26-year-old male underwent arthroscopic debridement and revision labral repair; 2) a 45-year-old female underwent biceps tenotomy, rotator cuff repair, and subacromial decompression; and 3) a 59-year-old male underwent arthroscopic rotator cuff repair, biceps tenodesis, and subacromial decompression.

Schick et al.[10] performed a retrospective case control review with 15,033 shoulder arthroscopy cases from 17 surgeons. The two study groups were the VTE group and the control group. Detailed information on each case of VTE was obtained through a review of surgical logs, including patient demographics, intraoperative details, any VTE prophylactic measures utilized or after surgery, and an extensive list of comorbidities and patient risk factors. Twenty-two patients of the 15,033 cases developed VTE (DVT: 15, PE: 8). Randelli et al.[16] reported six patients (DVT: 5, PE: 1) who developed VTE from 9,385 arthroscopy surgeries by 59 orthopaedic surgeons. Kuremsky et al.[13] reviewed 1,908 patients over five consecutive years that had undergone shoulder arthroscopy and reported five DVTs, four PEs, but no fatalities, with an overall thromboembolic complication rate of 0.31%. Hoxie et al.[19] reviewed 1,176 patients who underwent operative procedures for rotator cuff tears, and three patients (0.26%) developed PE, 1, 7, and 30 days postoperatively. For this case report, this patient had been the operating surgeon's only thromboembolic complication, which developed four days after arthroscopic Bankart lesion and rotator cuff repair, with a rate of 0.45%.

Arthroscopic shoulder surgery is safe with recent analysis reporting 30-day complication and readmission rates performed at 0.98%.[27] The most common reason for readmission was PE (0.09%). Orthopedic surgeons should be aware of the possibility for delayed complications, be able to recognize sentinel symptoms, and should take the appropriate steps in delivering therapeutic care. If precautions are not taken and symptomatic patients are not screened appropriately, the consequences could be dreadful.

Given the extreme rarity of the condition and wide variety of presentations, PE cannot be diagnosed reliably based on history and clinical examination alone.[28] Patients may present with upper extremity swelling, constitutional symptoms such as dyspnea, malaise, tachypnea, and tachycardia, pleuritic chest pain, discomfort with breathing, shortness of breath, and hypoxia as symptoms and signs of a potential VTE. However, most symptoms and signs of PE are not clinically obvious.[19,29] Doppler ultrasound, spiral pulmonary CT angiogram, D-dimer tests, ventilation-perfusion lung scan, pulmonary artery angiography, and echocardiography (both transthoracic and transesophageal) are investigations of choice in patients with suspected PE.[3,7,8,15,19,30,31] A CT angiogram is considered a criterion standard for a diagnosis of PE, but no single test is both sensitive and specific.[30,32]

In studies performed by Turkstra et al.[33] and Cortés et al.[21], ultrasonography in patients with angiographically-proven PE had only 29% sensitivity in detecting venous thrombi in the extremities. Yamamoto et al.[3] recommended serial D-dimer measurements in the perioperative period for detecting DVT/PE even in the arthroscopic shoulder surgery. In the current case, the origin of the embolus was unknown, but with a CT angiogram and D-dimer test, PE was diagnosed, even though a Doppler ultrasound showed no evidence of DVT in any extremity.

There is little evidence regarding the risk of and best methods to prevent VTE (either DVT or PE) associated with elective arthroscopic shoulder surgery. Different therapeutic strategies including thrombolytic therapy, surgical embolectomy, and anticoagulant medications have been recommended and used to reduce the mortality caused by PE. Using intravenous or oral anticoagulant medications is not without risk. The use of therapeutic anticoagulation increases bleeding episodes, specifically surgical site hematoma formation, therefore, is not suited to outpatient surgery or for short periods of treatment as it may take up to five days before a stable antithrombotic effect is achieved.

Muntz et al.[34] and Hingorani et al.[35] reported that using anticoagulation could prevent clot propagation, to facilitate the maintenance of venous collaterals and prevent PE. Thromboembolism after shoulder arthroscopy has been reported despite prophylaxis with low dose heparin.[23] Randelli et al.[16] surveyed 59 surgeons about 9,385 shoulder arthroscopies, concluding that twenty surgeons (33.9%) used chemoprophylaxis routinely; six DVTs were reported. Jameson et al.[12] reported on 65,302 shoulder arthroscopies over 42 months after the institution of British national thromboprophylaxis guidelines. Results for both the DVT and PE rates were 0.01%, which was similar to that of the population at large.

PE that develops after upper extremity surgery arises mainly from the ipsilateral axillary subclavian venous system, either of the lower extremities, or on the contralateral axillary vein.[15,36] In our case, the PE involved the medial segment of the right middle lobe of lung. Cortés et al.[21] stated that ipsilateral venous injuries have been associated with venous irritation or compression by the shaver, subcutaneous edema around the shoulder by the extravasation of irrigation fluid, excessive arm traction, and inadequate positioning of the arm.

Several risk factors contribute to the development of PE following shoulder arthroscopic surgeries, including age, cancer history, hereditary thrombophilia, personal or family history of thromboembolism, tobacco abuse, diabetes mellitus, and obesity.[1,11,17,18,23,26,37] Our patient had several risk factors including long operative time, obesity, and inflammatory bowel disease (IBD). A prolonged surgical time, caused by the difficulties in repairing the bony Bankart lesion, may have been one factor. Individuals with IBD have been shown to have an approximately 3-fold risk of DVT or PE compared to the general population.[38] This risk correlates positively with active disease and degree of colonic involvement.[39] There have been reports, however, of DVT and PE after shoulder arthroscopy with no discernable intrinsic risk factors in the patient.[14]

Some authors have speculated about the roles that patient positioning and traction play in increasing VTE risk in shoulder arthroscopy.[21] There have been reports of VTE after shoulder arthroscopy in both the beach chair and lateral decubitus positions, with and without traction.[14-16,21,22,40] Kuremsky et al.[13] performed large retrospective series of arthroscopy in 1,908 patients over a 5-year period, and all were done in the lateral decubitus position with traction. Their result showed a VTE rate of 0.31%. This casts doubt on the role lateral positioning and traction play in VTE during arthroscopy; a definitive answer, however, did not appear to exist in the literature.

CONCLUSION

Thromboembolic events after shoulder arthroscopy are rare events, but may prove life threatening. Current guidelines do not recommend the use of routine DVT chemoprophylaxis for shoulder arthroscopy patients. Surgeons should be aware of predisposing factors, various signs and symptoms with which thromboembolism may present in their patients to facilitate an early diagnosis and timely treatment when symptoms of thromboembolism arise; however, additional research for clinical validation is required.

INFORMED CONSENT

Institutional Review Board (IRB) approval was not required for this case report; however, the patient was informed that data about the case would be submitted for publication. The patient agreed and informed consent was signed.

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Keywords: pulmonary embolism, rotator cuff, arthroscopy, orthopedic surgery

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CASE REPORT

Hydroxyurea-Induced Interstitial Pneumonitis: A Rare Clinical Entity

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INTRODUCTION

Hydroxyurea is a cytoreductive agent indicated in the treatment of variety of malignant and nonmalignant conditions.[1] It generally is well tolerated with a side effect profile including bone marrow suppression, gastrointestinal, cutaneous manifestations, and fever.[2] We present a case of hydroxyurea-induced interstitial pneumonitis manifesting with symptoms of progressively worsening shortness of breath and cough. The mechanism remains unclear; however, our experience and literature review is indicative of an underlying hypersensitivity disorder. Clinicians should be aware of this unusual, yet life threatening side effect.

CASE REPORT

A 69-year-old man with polycythemia vera was started on hydroxyurea. Two months later, he presented with dyspnea and productive cough. Computed tomography (CT; Figures 1 and 2) of the chest showed diffuse, bilateral, ground glass opacities, bilateral pleural effusions, septal thickening, and subcentimeter pulmonary nodules. There was no history of notable environmental exposures.

With no obvious etiology, an extensive investigation was initiated. Echocardiogram showed an ejection fraction of 45-50% with decreased left ventricular contractility. Pulmonary function testing revealed a new restrictive pattern with a low diffusion capacity (Table 1). There was a concern for a cardiac etiology versus hydroxyurea-induced lung injury. Hydroxyurea was tapered and discontinued. However, his symptoms continued to worsen resulting in acute hypoxic respiratory failure.

Further evaluation included a bronchoscopy with bronchoalveolar lavage (BAL) which showed 30% lymphocytes and negative viral and bacterial cultures. A right and left heart catheterization did not demonstrate evidence of coronary artery disease or pulmonary hypertension. An autoimmune work up revealed an elevated ANA greater than 1280 (diffuse pattern). The patient did not meet diagnostic criteria for lupus as only two criteria were present at presentation: elevated ANA and evidence of serositis on imaging.

The patient was initiated on high dose prednisone for two weeks. He had a remarkable improvement in his pulmonary symptoms. The clinical scenario was consistent with hydroxyurea-induced pneumonitis based on literature review and clinical, imaging, and BAL studies. A month later, pulmonary function tests normalized with CT of the chest (Figures 3 and 4) showing near complete resolution of diffuse infiltrates and pulmonary nodules.

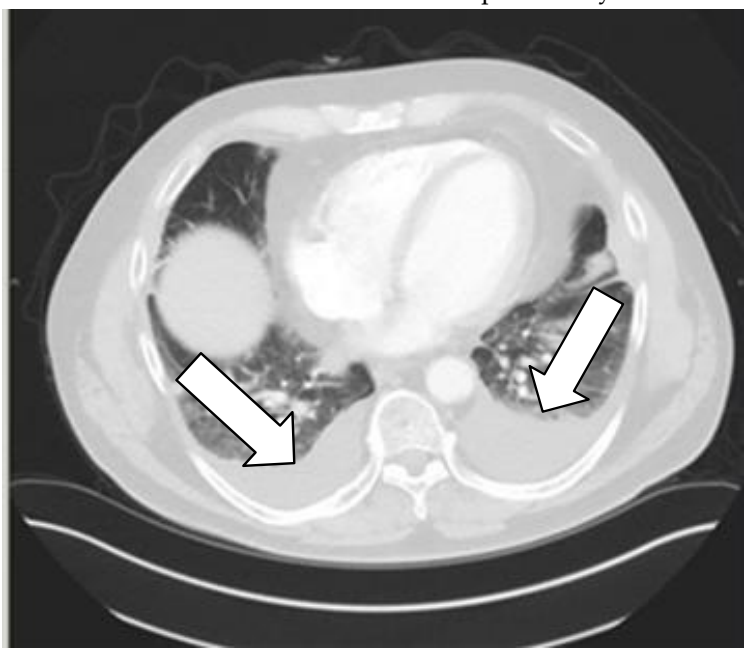

Figure 1. CT chest showed small to moderate right and left pleural effusion.

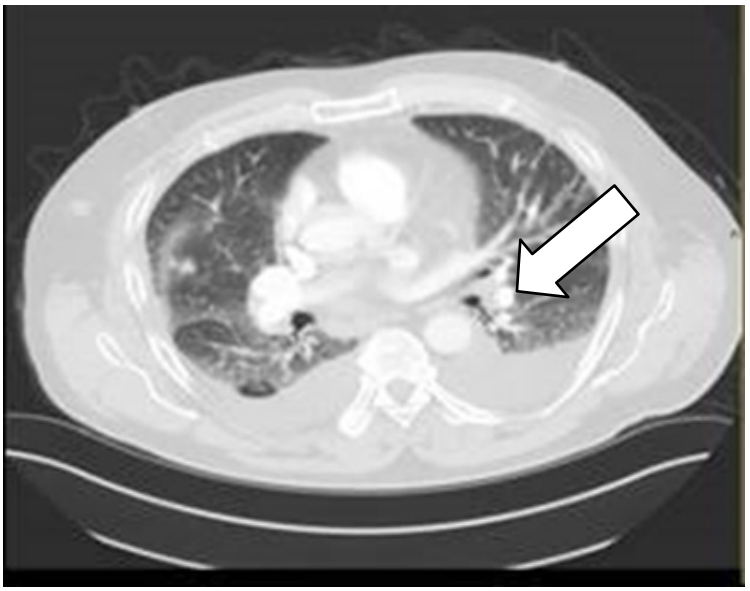

Figure 2. CT chest showed scattered pulmonary nodules in the right middle lobe.

Table 1. Initial pulmonary function tests showed mild restrictive pulmonary disease with a moderate defect in diffusion with noramlization on follow-up.

	Pre-Bronchodilator		
Spirometry	**Measure**	**Predicted**	**% Predicted**
Forced Vital Capacity (FVC; L)	3.90	5.24	74
Forced Expiratory Volume in 1 second (FEV1; L)	2.79	3.88	72
FEV1/FVC (%)	71	74	97
Forced Expiratory Flow 25% (L/sec)	7.04	8.29	85
Forced Expiratory Flow 50% (L/sec)	2.31	1.60	50
Forced Expiratory Flow 75% (L/sec)	0.53	1.45	36
Forced Expiratory Flow 25 - 75% (L/sec)	1.67	2.95	57
Forced Expiratory Flow Max (L/sec)	11.20	8.66	129
Forced Inspiratory Vital Capacity (FIVC; L)	3.68		
Forced Inspiratory Flow 50% (L/sec)	0.76	4.40	04
Lung Volumes			
Slow Vital Capacity (SVC; L)	3.91	5.24	75
Inspiratory Capacity (IC; L)	0.81	4.48	63
Total Gas Volume (TGV; L)	3.13	4.26	74
Residual Volume (RV; L)	2.30	2.68	86
Total Lung Capacity (TLC; L)	6.03	7.93	76
RV/TLC (L)	30	35	109
Diffusions			
Lung Diffusion Capacity Testing (DLCO; L)	16.15	28.20	57
Alveolar Volume (VA; L)	5.72	7.69	74
DLCO/VA (L)	2.82	3.70	76

DISCUSSION

Hydroxyurea is useful in controlling polycythemia vera-related symptoms, splenomegaly, leukocytosis, thrombocytosis, and hematocrit. However, hydroxyurea-treated patients can become resistant or experience unacceptable adverse effects (hyproxyurea intolerance), including skin ulcers, a reduction in blood cells, gastrointestinal problems, oral ulcers, stomatitis, hyperkeratosis, or actinic keratosis.[3] Hydroxyurea pulmonary toxicity is rare; reported cases consist mainly of acute alveolitis or interstitial pneumonitis. Quintás-Cardama et al.[1] reported the first case of acute alveolitis induced by hydroxyurea.

Figure 3. Comparative CT of the chest showed resolution of the left pleueral effusion.

Figure 4. Comparative CT of the chest showed resolution of the right pulmonary nodules.

A few case reports can be found in the literature to support this diagnosis.[3-5] The onset of symptoms develops within 4 - 12 weeks. Variation in presentation of hydroxyurea-induced lung injury exists and it remains a diagnosis of exclusion. Initial work-up should assess for infection, cardiac etiology, collagen vascular disease and environmental exposures. Lung biopsy was performed in some cases, however, it is not indicated if the suspicion is high.[3,4] Treatment includes withdrawal of offending agent and concurrent use of corticosteroids.

CONCLUSION

Hydroxyurea should be considered in differential diagnosis of atypical interstitial pneumonitis. If not diagnosed, hydroxyurea-induced interstitial pneumonitis may lead to acute respiratory failure.

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Keywords: interstitial lung diseases, hydroxyurea, hypersensitivity

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