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Original article

Impact of cardiovascular risk factor on the prevalence and severity of symptomatic full-thickness rotator cuff tears

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ABSTRACT

Introduction: The natural history of rotator cuff (RC) tears is likely multifactorial. Two theories have been put forward to explain them: extrinsic and intrinsic. Cardiovascular (CV) risk factors may be important in the context of the intrinsic theory.
Objectives: The objectives of this study were to demonstrate the influence of CV risk factors and their cumulative effect on the prevalence of symptomatic full-thickness RC tears and on the severity of these lesions.
Material and methods: A prospective observational case-control study was carried out with 206 consecutive patients undergoing arthroscopic rotator cuff repair. The control population consisted of 100 consecutive patients of the same age who had asymptomatic unoperated shoulders and were being operated in the orthopedics unit. The full-thickness RC tears were classified intraoperatively using the Southern California Orthopaedic Institute (SCOI) classification described by Snyder. CV risk factors were rated as either present or absent: smoking, high blood pressure (HBP), diabetes, alcoholism, dyslipidemia, obesity and CV history.
Results: Using a multivariate analysis, two factors were identified as having a significant influence on the prevalence of RC tears: smoking (OR = 8.715, 95%CI = 4.192–18.118, $P < 0.0001$) and dyslipidemia (OR = 4.920, 95%CI = 2.046–11.834, $P = 0.0004$). The following factors had a significant effect on the severity of RC tears: smoking (OR = 1.98, $P = 0.0341$, 95%CI = 1.05–3.74), HBP (OR = 3.215, $P = 0.0005$, 95%CI = 1.67–6.19) and history of CV disease (OR = 6.17, $P < 0.0001$, 95%CI = 2.5–14.78). The case patients had an average of 2.09 CV risk factors while the control patients had an average of 0.74 (OR = 3.56, 95%CI = 2.18–6.33, $P = 0.0012$). The average number of CV risk factors increased as the severity of the tear increased: 0.19 for stage 1, 1.75 for stage 2, 2.75 for stage 3 and 2.90 for stage 4.
Discussion: Modification of the vascular background appears to influence the severity and prevalence of tears. This corroborates anatomical studies in which a hypovascular area was identified in the tendon, 10–15 mm from the lesser trochanter attachment. Smoking, high blood pressure and obesity have been identified in other published studies as risks factors for the severity and prevalence of RC tears. However, it will be important to dissociate prevalence issues from that of RC healing in patients with compromised vascularity.
Conclusion: Cardiovascular risk factors have a significant role in the pathology of RC tears. The prevalence of RC tears is greater in patients who smoke or have dyslipidemia. Their severity is greater in patients who smoke, have high blood pressure or have experienced at least one CV event. The next step will be to study how these factors affect tendon healing, as this information could change our indications for cuff repair.
Level of evidence: Prospective cohort study level 2.

1. Introduction

The prevalence of rotator cuff (RC) tears makes this condition a public health problem. This brings up questions about their pathogenesis, ability of practitioners to prevent or stop progression to

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rupture and how to optimize RC repair indications. Classically, two theories have been put forward: extrinsic theory of mechanical causes according to Neer and Bigliani [1–3], and the intrinsic theory of degenerative causes first suggested by Codman [4].

Cardiovascular (CV) risk factors may be important in the context of the intrinsic theory. Although the relationship of blood pressure and smoking with RC tears has been demonstrated by Gumina et al. [5,6], no study up to now has looked at the cumulative effects of CV risk factors on the occurrence and severity of RC tears.

The objectives of this study were to demonstrate the influence of CV risk factors and their cumulative effect on the prevalence of symptomatic full-thickness RC tears and on the severity of these lesions.

2. Materials and methods

2.1. Study population

This was a prospective observational case-control study of 206 consecutive patients undergoing arthroscopic RC repair carried out between January and December 2013. A control group of 100 consecutive patients of the same age with asymptomatic, unoperated shoulders who were operated in the same orthopaedic unit was put together. The two populations had similar average ages (57.8 ± 8.6 years for the cases and 59.4 ± 12.3 years for the controls), sex ratio (60% men in the case group and 55% in the control group), and the proportion performing manual labor (42% versus 38% in the control population) (Table 1).

2.2. Study overview

The primary objective was to evaluate the effect of CV risk factors on the prevalence of RC tears. The exposure of the case and control groups to various risk factors was compared. The secondary objective was to evaluate the effect of CV risk factors on the severity of RC tears. In view of this objective, the case group was divided into two subgroups: one of 116 patients with "moderate tears" (SCOI

Table 1

Exposure of case and control populations to the various risk factors; univariate analysis with Chi^2 test of the risk factors assumed to be involved in occurrence of rotator cuff tears.

	RC tear	Control	OR	95% CI	P (Chi^2)
Sex M (%)	60	55	1.263	0.78–2.04	0.3441
Age (years)	57.8	59.4	1.546	0.96–2.5	0.0756
BMI	27.34	26.35	2.554	1.4–4.58	0.0017
Smoker (%)	54	10	10.516	5.18–21.35	<0.0001
Alcoholism (%)	13	8	1.735	0.76–3.97	0.192
HBP (%)	38	23	2.040	1.18–3.52	0.0102
Dyslipidemia (%)	36	7	7.606	3.35–17.25	<0.0001
CV history (%)	21	4	6.518	2.27–18.71	0.0005
Diabetes (%)	14	9	1.420	0.64–3.17	0.3919
No. of CV risk factors	2.09	0.74	3.56	2.18–6.33	0.0012

stage 1, 2, 3) and one of 90 patients with "severe tears" (SCOI stage 4) (Fig. 1).
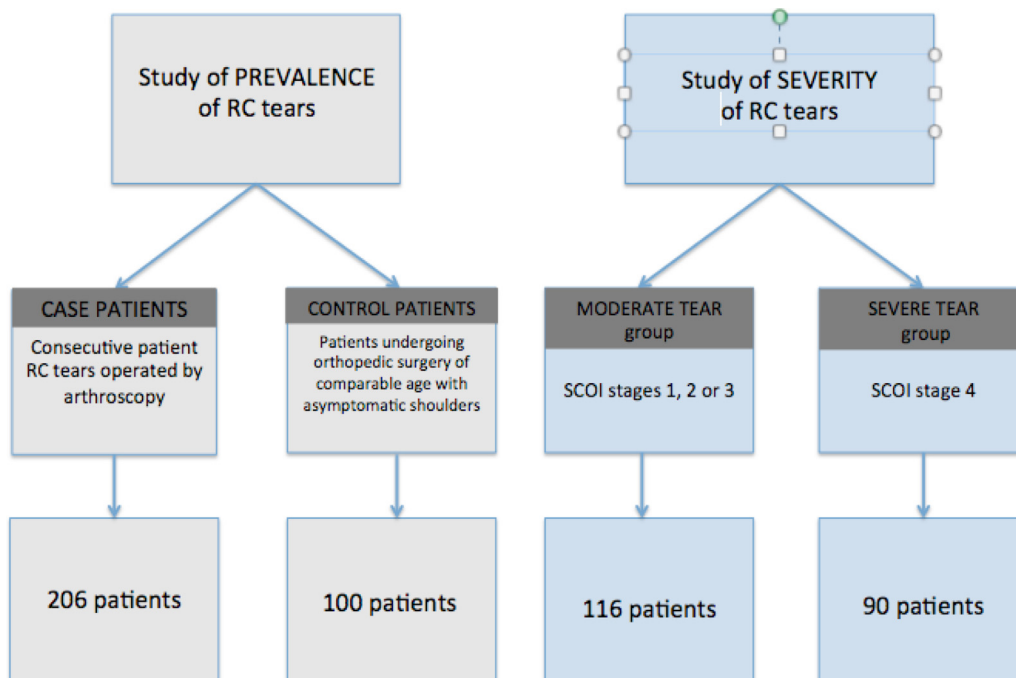
2.3. Outcome measures

2.3.1. Outcome measures for RC tears

All patients underwent a preoperative assessment consisting of a full clinical examination, standard A/P and lateral (Lamy) X-ray views of the shoulder and CT arthrography. The RC injuries were evaluated intraoperatively based on quantitative objective criteria. Only full-thickness tears were included; they were classified using the Southern California Orthopaedic Institute (SCOI) classification system developed by Snyder [7].

2.3.2. Evaluation of CV risk factors

Cardiovascular risk factors were analyzed as a binary event (present or absent) in a prospective manner during preoperative consultations:

- a patient was considered as hypertensive if he/she was being treated for high blood pressure (HBP) or was previously diagnosed with HBP by a generalist or specialist

Fig. 1. Study design.