ORIGINAL ARTICLE

Characterizing Occupational Low Back Pain among Surgeons Working in Ministry of Health Hospitals in Jeddah City: Prevalence, Clinical Features, Risk, and Protective Factors

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Abstract

A cross-sectional study was conducted to investigate the prevalence as well as the determinants and clinical features of occupational low back pain among surgeons working at Ministry of Health hospitals in Jeddah, Saudi Arabia by exploring its history combined with time of onset after starting the operating room work and self-appraisal of the relationship with the surgical work. Factors and predictors such as professional, socio-demographic and lifestyle factors, medical history, etc. were collected and analyzed. Two hundred and sixteen surgeons (69.9% males, mean age 39.03 years, median work: 5.00 years) responded. Prevalence of occupational low back pain was 55.8% (95% CI: 49.0%, 62.3%); high rates of inadequate management and self-treatment had a notable impact on all 4 domains. Multivariate regression showed two independent protective factors (regular physical exercise [OR = 0.27, P = 0.002] and back health education [OR = 0.41, P = 0.031] and two independent risk factors (high exposure to risky activities [OR = 1.06, P = 0.048] and presence of chronic pain other than back pain [OR = 2.59, P = 0.012]). More than one in two surgeons are likely to suffer from occupational low back pain. The protective roles of regular physical activity and back health education are highlighted.

Keywords

Occupational; Low back pain; Surgeons; Prevalence; Impact; Risk Factors; Prevention; Education

Introduction

The worldwide prevalence of chronic low back pain (LBP) was estimated between 4.2% and 25.4% depending on the population characteristics, region and age category[1]; with up to 42% reported point and lifetime prevalence[2,3]. Besides these disturbing epidemiological pictures, LBP has a major effect on social and professional activities since the functional capacity of the individual is restricted by pain; thus, it represents a significant cause of absenteeism[4].

Focusing on the healthcare workers, LBP is an annoying problem that could affect the work process. In a recent prospective study conducted in France, approximately one-quarter of the healthcare workers with LBP did not return to their regular work during a 2-year follow-up period[5]. Estimates show that 47%-70% of healthcare workers had LBP, with a point-prevalence of 30%[6,7]. In Kingdom of Saudi Arabia (KSA), a recent study conducted in the Eastern Region concluded that the majority of Saudi healthcare workers complain of LBP once in their lives with a prevalence of 79%; most were work-related[8].

On the other hand, approximately 4 out of 10 cases of LBP are attributed to occupational exposures[9]. Several work activities and professional circumstances have been identified as precursors for LBP, which makes occupational LBP (OLBP) a distinct entity.

Among the community of healthcare workers, surgeons are particularly vulnerable to experiencing OLBP compared to other specialties[6]. Studies showed that 70%-85% of surgeons complained from LBP in their lifetime[10,11]. Furthermore, chronic LBP among surgeons would eventually lead to significant impairments in work performance, which may affect the quality of patient's care and surgical outcomes and induce considerable healthcare costs, besides the substantial impact on the surgeon's quality of life[12].

However, several studies conducted among surgeons did not explore the occupational nature of LBP, which may lead to misinterpretations of the presented epidemiological pictures and confusions with non-occupational LBP that may be pre-existing or due to extra-occupational etiology such as trauma, sport injuries, *etc*. Thus, identifying OLBP among surgeons would provide more accurate evaluation of the back-health risks related to the surgical profession, which would enable establishing more specific correlations with the work environment risk factors and protective measures.

The authors wanted to investigate the prevalence and clinical characteristics of OLBP among surgeons working in healthcare institutions of the Ministry of Health (MOH) in Jeddah, Saudi Arabia; as well as to identify eventual independent risk or protective factors of an occupational or extra-occupational nature.

Methods

Population and Setting

This cross-sectional study involved surgeons working at five MOH hospitals in Jeddah, Saudi Arabia, including King Fahad General Hospital, King Abdul-Aziz Hospital and Oncology Center, Al Thagher Hospital, King Abdullah Medical Complex, and East Jeddah Hospital. Inclusion criteria applied for both gender and all nationality and age category residents, board-certified specialists and consultants in surgery. All surgical subspecialties were included, while other operatory room staff was not included. This study was approved by the Directorate of Health Affairs, MOH, Jeddah; and researchers received relevant authorizations from all participating hospitals' directors and surgery departments' heads to collect the data specified in the study protocol.

Sampling

Sample size was calculated to detect 70% prevalence of low back pain[10] among a finite population of 503 surgeons working in the participating centers, with a 95% confidence interval, 80% statistical power, and 5% type I error. The calculated sample size was N = 197.

A convenience sampling technique was used to include all eligible participants until reaching the target sample size, with respect of a proportional allocation by hospital as per the respective number of surgeons.

Data Collection Tool

This study used a semi-structured questionnaire that was designed by the authors, comprising a modified version of a validated questionnaire published in a previous study by Bin Homaid *et al*.[10] that aimed to explore operatory room risk activities (ORRA) among operatory room staff in Makkah, Saudi Arabia. The

questionnaire included the following nine parts: 1) Professional data: hospital name, subspecialty, years of experience, and work years; 2) Socio-demographic data: age, gender, marital status, *etc*.; 3) Lifestyle factors: smoking, physical exercise, hobbies, *etc*.; 4) Past medical history: specific back history (back trauma, surgery, injury, *etc*.), other medical and surgical history (other surgery, other trauma, co-morbidities, *etc*.); 5) Physical and psychological stress at work: perceived level of stress, hours of standing, hours of sitting, *etc*.; 6) ORRA, which explored surgeons' exposure to 8 different activities/postures (e.g. lifting, transferring, or pulling patients/objects) during a routine work time, as adapted from study by Bin Homaid *et al*.[10] and that was modified by using a 5-point Likert type frequency scale (from never = 0, to very frequently = 4); 7) OLBP assessment, which was carried out by exploring history of LBP in addition to 2 discriminative criteria including time of onset (before vs after starting the operating room job) and self-appraisal of the relationship of LBP with the surgical work; 8) OLBP characteristics: pain severity, frequency and evolution pattern over the last 12 months, care-seeking behavior, etiology and diagnosis, and management; 9) Self-reported impact of OLBP on 4 dimensions including professional achievement, social relationships, psychological well-being, and activities of daily life.

After face- and content-validation of the questionnaire, an electronic version was adapted and published in an online survey platform and the related Uniform Resource Locator (URL) was obtained.

Data Collection Method

First, the online questionnaire URL was diffused via group messaging, by adding all phone numbers of all surgeons; these were provided beforehand by the hospitals' human resource administrators upon authorization of the respective directors and head managers. The questionnaire URL was accompanied with a short message soliciting for participation in the study and presenting its aim and relevance. However, due to the very low response rate (5.2%), the researchers called each surgeon individually and reiterated the call for participation by presenting the importance of the study in a persuasive and constructive debate. The study URL was closed on 14 March 2019 after reaching 216 participants.

Statistical methods

Statistical analysis was performed with the IBM SPSS Statistics for Windows, Version 21 (IBM Corp., Armonk, NY USA). The prevalence of OLBP was calculated as the percentage of surgeons who declared having LBP with onset after start of operatory room work (to exclude anterior symptoms) and being fairly associated to the profession as per the participant's subjective judgment on a Likert-type probability scale (to exclude extra-occupational etiology). Results are presented with a 95% confidence interval. Descriptive statistics were used to present socio-demographic, professional, lifestyle factors and job-associated stressors, in addition to OLBP characteristics and multidimensional impact. Categorical variables were presented as frequency and percentage, while numerical variables were presented as mean ± Standard Deviation (SD) for normally distributed variables and median (centile) for non-normally distributed ones. Regarding risky activities, an ORRA score (ORRAS) was calculated as the sum of the eight items' scores to indicate the overall level of exposure (ORRAS range = 0, 32). The internal consistency of related parts of the questionnaire was assessed by calculating Cronbach's alpha. Analysis of factors associated with OLBP used chi-squared test or Fisher's exact test for categorical variables, as appropriate, independent t-test for normally distributed and Mann-Whitney U test for non-normally distributed ones. Multivariate binary logistic regression was carried out to analyze independent risk factors of OLBP by including all statistically significant factors; results were presented as odds-ratio (OR) with 95% confidence interval (95% CI). A p value of < 0.05 was considered to reject the null hypothesis.

Results

Participants' Demographic and Professional Characteristics

Two hundred and sixteen surgeons responded to the questionnaire, 69.9% males, mean (SD) age of 39.03 (9.82) years and 78.3% were married. Of the participants, 32.7% were residents, 33.2% board-certified specialists, and 34.1% were consultants, with median (P90) experience of 10.00 (25.00) years; with sub Table 1).

Table 1. Participants' demographic and professional characteristics.

Parameter	Category	Frequency	Percentage
Socio-demographic data			
Gender	Male	158	69.9%
	Female	68	30.1%
Age (Years)	Mean, SD	39.03	9.82%
Marital Status	Single	42	18.6%
	Married	177	78.3%
	Divorced	5	2.2%
	Widowed	2	0.9%
No. children	None	59	26.1%
	1-2	69	30.5%
	3+	80	35.4%
Professional data			
Hospital	Al Thagher Hospital	25	11.1%
	East Jeddah Hospital	42	18.6%
	King Abdul-Aziz Hospital and Oncology Center	64	28.3%
	King Abdullah Medical Complex	28	12.4%
	King Fahad General Hospital	67	29.6%
Degree	Consultant	77	34.1%
	Resident	74	32.7%
	Board-certified specialist	75	33.2%
Years of experience	Median, P90	10.00	25.00
Subspecialty	Bariatric	6	2.7%
	Breast Oncology/Surgery	5	2.2%
	General Surgery	81	35.8%
	Orthopedic	25	11.1%
	Obstetrics/Gynecology	18	8.0%
	Otolaryngology	14	6.2%
	Pediatric Surgery	3	1.3%
	Neurosurgery	5	2.2%
	Urology	22	9.7%
	Maxillofacial	17	7.5%
	Plastic Surgery	8	3.5%
	Surgical Oncology	2	0.9%
	Gynecological Oncology	7	3.1%
	Other (Specified)	13	5.8%
Years of work	Median, P90	5.00	20.00

Because of missing data, all frequencies do not sum up to the total. Values are frequency/percentage, except if otherwise specified. P90: 90th centile; other sub-specialties included: ophthalmology (3), thoracic surgery (3), vascular surgery (2), colorectal surgery (2), anesthesia (1), gastroenterology endoscopic surgery (1), and gynecology and infertility (1).

Participants' Lifestyle and Clinical Characteristics

Of the total participants, active smoking was present among 28.3% with a median (P90) duration of 9.0 (20.0) years of smoking and an average of 5 (20) cigarettes per day. Other lifestyle characteristics showed low rates of regular exercise (36.3%) and hobbies and extra-professional activities (21.7%). Back history showed 16.8% of back injury in various circumstances including trauma (8.0%), sport injury (4.0), surgery (1.8%), or other causes (8.8%). Other medical data were characterized by high prevalence of overweight (35.8%) and obesity (36.3%), with remarkably low medical history of hypertension (12.4%) and type II diabetes (5.3%) (Table 2).

Physical and Psychological Stress at Work

A majority of the surgeons declared undergoing high (40.7%) or very high (15.9%) levels of stress during their work. The median (P90) average standing and sitting hours in a workday were 9.00 (20.00) and 5.00 (20.00) hours, respectively. Regarding operatory room risky activities (ORRA), the most frequently performed activities were lifting objects above the

Table 2. Participants' lifestyle and clinical characteristics

Parameter	Category	Frequency	Percent
Lifestyle data			
Home-job transportation mean	Drive own car	147	65.0%
	Private driver	52	23.0%
	By taxi	8	3.5%
	On foot	19	8.4%
Smoking	Never	134	59.3%
	Ever	92	40.7%
	Previously	*27*	*11.9%*
	Currently	*64*	*28.3%*
Type	Cigarettes	55	24.3%
	Shisha	36	15.9%
Smoking duration	Median, P90	9.00	20.00
No. cigarettes per day	Median, P90	5.00	20.00
Regular physical exercise	No	75	33.2%
	Yes	151	66.8%
Weekly exercise frequency	Median, SD	3.00	6.00
Exercise (3 categories)	None	75	33.2%
	Irregular (< 3 times/week)	69	30.5%
	Regular (≥ 3 times/week)	82	36.3%
Hobbies and extra-professional activities	No	177	78.3%
	Yes	49	21.7%
Holidays and travel	Always	101	44.7%
	Often	92	40.7%
	Rarely	30	13.3%
	Never	3	1.3%
Medical data			
Height (cm)	Mean, SD	169.80	9.42
Weight (kg)	Mean, SD	83.25	20.23
BMI (kg/m^2)	Mean, SD	28.75	5.91
BMI categories (kg/m^2)	Underweight (< 18.5)	1	0.4%
	Normal (18.5-< 25)	62	27.4%
	Overweight (25-< 30)	81	35.8%
	Class I obesity (30-< 35)	51	22.6%
	Class II obesity (35-< 40)	20	8.8%
	Class III obesity (40+)	11	4.9%
Current pregnancy	No	64	28.3%
	Yes	4	1.8%
	N/A (males)	158	69.9%
History of back injury	Never	188	83.2%
	Ever [§]	38	16.8%
	Trauma	*18*	*8.0%*
	Sport injury	*9*	*4.0%*
	Surgery	*4*	*1.8%*
	Other	*20*	*8.8%*
Other surgical history	No	151	66.8%
	Yes	75	33.2%
Other trauma history	No	175	77.4%
	Yes	51	22.6%
Other medical history	No	156	69.0%
	Yes	70	31.0%
	Hypertension	*28*	*12.4%*
	Type II diabetes	*12*	*5.3%*
	B.A or allergic rhinitis	*13*	*5.8%*
	Other	*24*	*10.6%*

Because of missing data, all frequencies do not sum up to the total. Values are frequency/percentage, except if otherwise specified. P90: 90th centile; [§] a participant may have more than one injury; other medical history included hypothyroidism (7 cases), coronary artery disease (2), hyperlipidemia (3), hyperprolactinemia (2), migraine (2), anemia (1), atrial fibrillation (1), gout (1), hyperthyroidism (1), rheumatological disease (1), simple renal cyst (1), and thrombophilia A (1), in addition to two unspecified cases.

Table 3. Assessment of physical and psychological stress at work among surgeons

Parameter	Level	Frequency	Percent
Stress level at work	Low	10	4.4%
	Moderate	88	38.9%
	High	92	40.7%
	Very high	36	15.9%
Average standing hours per workday	Median, P90	9.00	20.00
Average sitting hours per workday	Median, P90	5.00	20.00
ORRA			
Lifting objects above the waist	Never	22	9.7%
	Rarely	63	27.9%
	Occasionally	72	31.9%
	Frequently	57	25.2%
	Very frequently	12	5.3%
Rotating torso while bearing weight	Never	58	25.7%
	Rarely	75	33.2%
	Occasionally	60	26.5%
	Frequently	27	11.9%
	Very frequently	6	2.7%
Bending to lift an item from floor level	Never	40	17.7%
	Rarely	67	29.6%
	Occasionally	60	26.5%
	Frequently	39	17.3%
	Very frequently	20	8.8%
Transferring a patient from bed to chair/chair to bed	Never	42	18.6%
	Rarely	70	31.0%
	Occasionally	54	23.9%
	Frequently	50	22.1%
	Very frequently	10	4.4%
Transferring a patient onto a stretcher	Never	50	22.1%
	Rarely	67	29.6%
	Occasionally	47	20.8%
	Frequently	51	22.6%
	Very frequently	11	4.9%
Ambulating a patient	Never	72	31.9%
	Rarely	87	38.5%
	Occasionally	45	19.9%
	Frequently	19	8.4%
	Very frequently	3	1.3%
Pulling a patient up the bed	Never	41	18.1%
	Rarely	96	42.5%
	Occasionally	52	23.0%
	Frequently	30	13.3%
	Very frequently	7	3.1%
Repositioning a patient in bed	Never	35	15.5%
	Rarely	91	40.3%
	Occasionally	62	27.4%
	Frequently	29	12.8%
	Very frequently	9	4.0%
Education/ information received on how to protect back and prevent LBP?	No	125	55.3%
	Yes, but inadequate	55	24.3%
	Yes, adequate	46	20.4%

Because of missing data, all frequencies do not sum up to the total. Values are frequency/percentage, except if otherwise specified. P90: 90th centile; OR: operating room risky activities; LBP: low back pain; operatory room risk activities levels: Never, Rarely: 1-2 times per month, Occasionally: 1-2 times per week, Frequently: several times per week, Very frequently: daily

waist, transferring a patient from bed to chair/chair to bed and transferring a patient onto a stretcher. Further, only 44.7% reported having received information/education on how to protect their back and prevent LBP and only 20.4% deemed the education received as adequate (Table 3).

Analysis of ORRAS showed mean = 12, SD = 6.30 and median = 12, and study of the distribution showed Kolmogorov-Smirnov test (statistics = 0.083, p = 0.001) and Shapiro-Wilk test (statistics = 0.984, p = 0.012), indicating that the variable is not normally distributed. Internal consistency analysis of the ORRA scale including the eight items showed Cronbach's alpha = 0.868, indicating a high reliability of the subscale.

Characterization of OLBP

History of LBP was reported in 192 of the total surgeons, indicating a prevalence of 85.0% (95% CI = 79.6%, 89.4%). Of the 192 surgeons, 156 surgeons (69.0% of the total surgeons) declared that their LBP first occurred after starting their OR activity and 150 (66.4%) believed it is probably, very probably or definitely related to their job; which results in 126 having both criteria and more likelihood of having OLBP (prevalence [95% CI] = 55.8% [49.0%, 62.3%]).

Findings of clinical characteristics of OLBP are depicted in Table 4. These revealed that 32.5% of the afflicted surgeons consulted a physician for their OLBP and 25.4% underwent an MRI or CT-scan; and the proposed etiological diagnoses were muscular injury or dysfunction (20.6%), discopathy (14.3%), degenerative disease (4.0%), sacroiliitis (1.6%) and functional LBP without any anatomical lesion (4.8%); whereas 54.8% of the cases remained without diagnosis. Yearly frequency of OLBP episodes ranged between 0 to 300+ episodes per year (median = 6, P90 = 33), with the latest episode occurring in the past few days among 38.1% of the cases. Severity of the pain showed mean (SD) pain score = 5.01 (1.84) for the latest episode and 6.45 (2.18) for the most painful episode. Regarding management, rest (48.4%), NSAIDs (27.6%) and physiotherapy (26.6%) were the most frequently used options; however, opioid analgesics have been used by 2.6% of the afflicted surgeons (Fig. 1). Regarding the impact on life domains, OLBP yielded great impact on professional achievement, social relationships, ADLs and psychological well-being in 13.5%, 5.6%, 12.7% and 24.6% of the cases, respectively; while a moderate impact was reported among 33.3% to 40.5% depending on the domain (Table 4).

Factors Associated with OLBP

Demographic and professional factors associated with OLBP as well as lifestyle and clinical factors are depicted in Table 5. No statistically significant association of OLBP was found with any of the investigated demographic

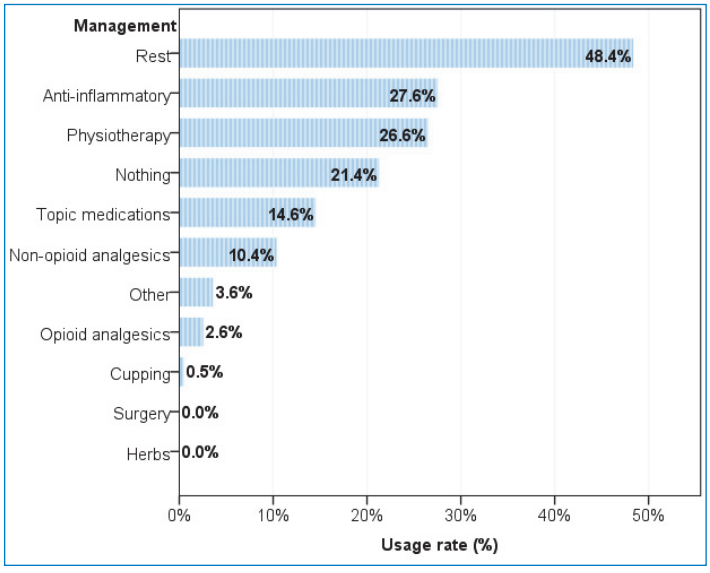

Figure 1. Management options used among surgeons who declared ever experiencing low back pain (N = 192) Bars represent the percentage of surgeons of who already used the given management option among those who declared having ever had low back pain. A participant may use more than one option. Other management options included massage and physiotherapy (5 cases), stretching or exercise (4), weight reduction (1) and behavioral change (1)

Table 4. Characteristics and impact of occupational low back pain among afflicted surgeons (N=126)

Parameter	Category	Frequency	Percent
Consulted a physician	No	85	67.5%
	Yes	41	32.5%
Had MRI and or CT-scan	No	94	74.6%
	Yes	32	25.4%
Diagnosis / etiology	Discopathy	18	14.3%
	Muscular	26	20.6%
	Degenerative	5	4.0%
	Sacroiliitis	2	1.6%
	Non-specific / Functional	6	4.8%
	Unknown / Not Specified	69	54.8%
In your opinion, is your LBP related to your job?	No not related	0	0.0%
	Probably not	0	0.0%
	Possibly	0	0.0%
	Probably	36	28.6%
	Very probably	31	24.6%
	Definitely	59	46.8%
No. episodes past year	Median, P90	6	33
Latest episode time	> 3 months	21	16.7%
	1-3 months	21	16.7%
	1 week - 1 month	36	28.6%
	A few days ago	48	38.1%
Evolution pattern	Decreasing	31	24.6%
	By intermittent peaks	60	47.6%
	Constant intensity	27	21.4%
	Increasing	8	6.3%
Latest episode severity	Mean, SD	5.01	1.84
Most painful episode severity	Mean, SD	6.45	2.18
Usual Management	Nothing (wait until it passes away)	14	11.1%
	Rest	57	45.2%
	Self-medication	46	36.5%
	I see a physician/specialist	3	2.4%
	Other, specify	6	4.8%
Chronic pain in other area	No	70	55.6%
	Yes	56	44.4%
Impact of LBP			
Job achievement	Not at all	13	10.3%
	Very little	46	36.5%
	Somewhat	50	39.7%
	To a great extent	17	13.5%
Social relationships	Not at all	23	18.3%
	Very little	45	35.7%
	Somewhat	51	40.5%
	To a great extent	7	5.6%
Activities of daily life	Not at all	17	13.5%
	Very little	42	33.3%
	Somewhat	51	40.5%
	To a great extent	16	12.7%
Psychological wellbeing	Not at all	11	8.7%
	Very little	42	33.3%
	Somewhat	42	33.3%
	To a great extent	31	24.6%

Values are frequency/percentage, except if otherwise specified. P90: 90th centile; SD: Standard deviation; LBP: Low back pain; OLBP: Occupational low back pain; OLBP criteria: 1= LBP first occurred after starting the OR job, 2=LBP described by the participant as being probably related to job, 3= LBP first occurred after starting OR job and described by participant as being probably related

Table 5. Demographic, professional, lifestyle and clinical factors associated with occupational low back pain among surgeons

Parameter	Category	OLBP				P-value
		No (N = 100)		Yes (N = 126)		
		Frequency	Percent	Frequency	Percent	
Socio-demographic factors						
Gender	Male	72	45.6%	86	54.4%	0
	Female	28	41.2%	40	58.8%	0.542
Age (years)	Mean, SD	39.24	10.54	38.86	9.25%	0.772[t]
Marital Status	Single	19	45.2%	23	54.8%	0
	Married	78	44.1%	99	55.9%	0
	Divorced	1	20.0%	4	80.0%	0
	Widowed	2	100.0%	0	0.0%	0.292
No. children	None	26	44.1%	33	55.9%	0
	1-2	32	46.4%	37	53.6%	0
	3+	35	43.8%	45	56.3%	0.943
Professional factors						
Degree	Consultant	36	46.8%	41	53.2%	0
	Resident	36	48.6%	38	51.4%	0
	Board-certified specialist	28	37.3%	47	62.7%	0.328
Years of experience	Median, P90	9.00	27.70%	10.50	25.00%	0.475[M]
Subspecialty	Bariatric	3	50.0%	3	50.0%	0
	Breast oncology/surgery	3	60.0%	2	40.0%	0
	General surgery	34	42.0%	47	58.0%	0
	Orthopedic	11	44.0%	14	56.0%	0
	Ob-gyne	5	27.8%	13	72.2%	0
	ENT	6	42.9%	8	57.1%	0
	Pediatric surg.	3	100.0%	0	0.0%	0
	Neurosurgery	3	60.0%	2	40.0%	0
	Urology	6	27.3%	16	72.7%	0
	Maxillofacial	11	64.7%	6	35.3%	0
	Plastic surgery	4	50.0%	4	50.0%	0
	Surgical oncologist	1	50.0%	1	50.0%	0
	Gynecological oncology	3	42.9%	4	57.1%	0
	Other (specified)	7	53.8%	6	46.2%	0.440
Years of work	Median, P90	5.00	19.90%	6.00	20.60%	0.080[M]
Lifestyle factors						
Home-job transportation mean	Drive own car	64	43.5%	83	56.5%	0
	Private driver	21	40.4%	31	59.6%	0
	By taxi	5	62.5%	3	37.5%	0
	On foot	10	52.6%	9	47.4%	0.579
Smoking	Never	61	45.5%	73	54.5%	0
	Ever:	39	42.4%	53	57.6%	0.642
	Previously	*11*	*40.7%*	*16*	*59.3%*	*0*
	Currently	*28*	*43.8%*	*36*	*56.3%*	*0.791*
Type	Cigarettes	24	43.6%	31	56.4%	0
	Shisha	15	41.7%	21	58.3%	0.853
Smoking duration	Median, P90	10.00	18.80%	9.00	20.0%	0.967[M]
No. cigarettes per day	Median, P90	10.00	20.0%	5	20.0%	0.641[M]
Regular physical exercise	No	23	30.7%	52	69.3%	0
	Yes	77	51.0%	74	49.0%	0.004*
Exercise (times/week)	None	23	30.7%	52	69.3%	0
	Irregular	29	42.0%	40	58.0%	0
	Regular	48	58.5%	34	41.5%	0.002*

Table 5. Demographic, professional, lifestyle and clinical factors associated with occupational low back pain among surgeons--(CONTINUED)

Parameter	Category	OLBP				P-value
		No (N = 100)		Yes (N = 126)		
		Frequency	Percent	Frequency	Percent	
Hobbies and extra-professional activities	No	76	42.9%	101	57.1%	0
	Yes	24	49.0%	25	51.0%	0.451
Holidays and travel	Always	43	42.6%	58	57.3%	0
	Often	43	46.7%	49	53.3%	0
	Rarely	14	46.7%	16	53.3%	0
	Never	0	0.0%	3	100.0%	0.424
Clinical factor						
Height (cm)	Mean, SD	169.51	9,99%	170,03	8,98%	0.680[t]
Weight (kg)	Mean, SD	83.86	22.32%	82.76	18.48%	0.686[t]
BMI (kg/m^2)	Mean, SD	29.05	6.45%	28.52	5.47%	0.506[t]
History of any back injury	Never	79	42.0%	109	58.0%	0
	Ever [§]	21	55.3%	17	44.7%	0.134
Back trauma	No	88	42.3%	120	57.7%	0
	Yes	12	66.7%	6	33.3%	0.046*
Back sport injury	No	93	42.9%	124	57.1%	0
	Yes	7	77.8%	2	22.2%	0.081[F]
Back surgery	No	99	44.6%	123	55.4%	0
	Yes	1	25.0%	3	75.0%	0.632[F]
Other back injury	No	91	44.2%	115	55.8%	0
	Yes	9	45.0%	11	55.0%	0.943
Other surgical history	No	66	43.7%	85	56.3%	0
	Yes	34	45.3%	41	54.7%	0.817
Other trauma history	No	84	48.0%	91	52.0%	0
	Yes	16	31.4%	35	68.6%	0.035*
Other chronic pain history	No	50	41.7%	70	58.3%	0
	Yes	16	22.2%	56	77.8%	0.006*
Other medical history	No	77	49.4%	79	50.6%	0
	Yes	23	32.9%	47	67.1%	0.021*
Physical and psychological stress at work						
Perceived-stress level at work	Low	6	60.0%	4	40.0%	0
	Moderate	43	48.9%	45	51.1%	0
	High	40	43.5%	52	56.5%	0
	Very high	11	30.6%	25	69.4%	0.210
Average standing hours per workday	Median, P90	5.00	8.0%	6.00	8.0%	0.057
Average sitting hours per workday	Median, P90	3.00	5.90%	2.50	4.0%	0.051
ORRAS	Mean, SD	11.02	6.43%	12.98	6.08%	0.020*[t]
Received education to prevent LBP	No	48	38.4%	77	61.6%	0
	Yes, but inadequate	32	58.2%	23	41.8%	0
	Yes, adequate	20	43.5%	26	56.5%	0.048*

Because of missing data, all frequencies do not sum up to the total. Values are frequency/percentage, except if otherwise specified. P90: 90th centile; ORRAS: operatory room risky activities score.
**statistically significant result (P<0.050); test used: [M]Mann-Whitney U test, [t]independent t-test, [F]Fisher's exact test, otherwise: chi-square test*

Table 6. Predictors of occupational low back pain among surgeons (multivariate binary logistic regression)

Predictor	Level	OR	95% CI		P-value
Exercise (times/week)	None	*Ref*	0	0	0.004*
	Irregular	0.73	0.31	1.73	0.470
	Regular	0.27	0.12	0.61	0.002*
Other trauma history	Yes	1.60	0.72	3.56	0.251
Other medical history	Yes	1.04	0.50	2.18	0.912
Other chronic pain	Yes	2.59	1.23	5.43	0.012*
ORRAS	Score	1.06	1.00	1.12	0.048*
Education received	No	*Ref*	0	0	0.054*
	Inadequate	0.41	0.19	0.92	0.031*
	Adequate	1.21	0.51	2.89	0.669

*OR: Odd ratio; CI: confidence interval; Ref: level used as reference category for the regression model; * statistically significant result (P <0.05).*

and professional factors including gender, age, marital status, degree, years of experience or years of work, *etc*. Regarding lifestyle, the prevalence of OLBP was highest among surgeons who practiced no physical exercise (69.3%) and decreased to 58.0% and 41.5% among those who practiced exercise irregularly and regularly, respectively, and the comparison is statistically significant (p = 0.002). Paradoxically, history of back trauma was associated with lower prevalence of OLBP (33.3% versus 57.7%, P = 0.046); while history of sport injury (P = 0.081), surgery (p = 0.632), or other injuries (P = 0.943) of the back showed no significant association with OLBP. On the other hand, history of other trauma (68.6% versus 52.0%, P = 0.035), other chronic pain (77.8% versus 58.3%, P = 0.006), and other medical history (67.1% versus 50.6%, P = 0.021) were significantly associated with a higher prevalence of OLBP, compared to absence of these conditions, respectively.

Analysis of psychological stress showed no difference in the prevalence of OLBP between the different levels of perceived stress at work (p = 0.210); however, ORRAS was greater in the group of surgeons with OLBP (mean [SD] = 12.98 [6.08]) compared to their counterparts (mean [SD] = 11.02 [6.43]) and the difference was statistically significant (p = 0.020). Education to prevent LBP was associated with lower prevalence of OLBP compared to no education (P = 0.048); however, the group of surgeons who declared that the education they received was adequate exhibited relatively higher prevalence (56.5% versus 41.8%) compared to those who declared that the received education was inadequate (Table 5).

Independent Risk Factors of OLBP

Multivariate regression model including significant factors from the previous analysis showed two protective factors and two risk factors for OLBP. The two independent protective factors were regular physical exercise (OR = 0.27, P = 0.002) and education received that is deemed inadequate by the participant (OR = 0.41, P = 0.031). The two independent risk factors were ORRAS score (OR = 1.06, P = 0.048) and the presence of another chronic pain other than the back pain (OR = 2.59, P = 0.012) (Table 6).

Discussion

Summary of Findings

Performing surgical procedures is a psychologically and physically demanding task, and prolonged discomfort or stress of the surgeons may diminish their operatory skills and compromise their career path. Further, chronic and disabling pain resulting from an occupational disease not only impairs the quality of work life but also affects the overall quality of life of the individual. This study used a double-criterion method to estimate the prevalence of OLBP among surgeons and investigated the associated occupational and extra-occupational factors and predictors. According to the findings, more than one in two (55.8%) surgeons suffer from OLBP; which was defined as a LBP that first occurred after starting operating room job activity (criterion 1) with high likelihood of being related to job as per the participant's judgment (criterion 2).

Estimation of OLBP: a Methodological Issue

To date, there is no objective and reliable medical standard to discriminate OLBP from non-occupational LBP; as in many cases occupational and extra-occupational factors interlock or build up. Furthermore, occupational factors may only trigger silent preexisting abnormalities[13].

In the present study, use of the first criterion aimed at providing a timing-based objective benchmark for OLBP to discriminate it from non-occupational LBP, which reduced the number of cases (prevalence) from 192 (85.0%) to 156 (69.0%). The use of the second criterion, which relied on the participant's appraisal of the relationship between his / her LBP and professional activity, enabled the exclusion of 42 cases with low likelihood of OLBP. Crossing the two criteria aimed at reducing subjectivity in participant's appraisal and lead to excluding 24 cases described as likely being related to occupation, although symptoms onset occurred before starting OR job. Although this method may have some limitations in diagnosis, it could be considered for screening purposes.

Prevalence of OLBP

In literature, the prevalence of OLBP shows great variation depending on profession and or population, as well as on criteria used to define the outcome. For the present study, the profession and population was surgeons, while the outcome was the work-life prevalence of OLBP. Consistent with the findings, prevalence of LBP among surgeons were remarkably high in literature. For example, in Iran, the point prevalence of LBP among surgeons was reported to be 39.9%, while 1-year prevalence was 71.7% and lifetime prevalence was 84.8%[11]; however, the estimates included both occupational and non-occupational, which explains the higher rates compared to the present study. Rates of LBP are also high among operatory room staff similar to the findings from the studies conducted Bin Homaid *et al*.[10], where LBP was found to be as high as 74.2%[10], or that in Riyadh, showing 67%[14].

Although these rates are likely to be higher than common LBP in general population, they fall well within the range of estimates reported among healthcare workers, where the prevalence of LBP ranged between 47% and 74%[13,15,16]. Nevertheless, comparison between different specialties points towards a higher risk among surgical positions, as evidenced by a study among healthcare workers in Saudi Aramco that showed a significantly increased risk of back pain among surgeons with a remarkable odds ratio of 5.6[17]. Similar evidence was reported in a study showing a rate of 65.7% for LBP among nurses working at a tertiary care hospital in Jeddah; working in surgical departments was associated with the greatest risk (OR = 2.2) of LBP compared to other departments and by reference to medicine[6]. This indicates that the operating room working environment comprises specific harm that should be identified and corrected.

Care Seeking Behavior: a Specific Issue

Assessment of OLBP characteristics showed inadequate care-seeking behavior among surgeons as only one in three of those afflicted have already sought medical advice regarding their OLBP and only one in four have benefited from imaging investigations. This results in a majority of cases (54.8%) being undiagnosed and probably being inadequately managed and followed up. A meta-analysis showed that health care-seeking behavior among individuals with chronic LBP is mainly determined by the level of disability; while other factors such as being female or having a history of back pain may also be associated with higher rates of care seeking[18]. In the present study, cases with disabling LBP are probably excluded from the population and can be considered biased, as only practicing surgeons were included while those on sick leave or unfit for work were not surveyed.

Professional and Psychosocial Impact of OLBP

Despite the low rates of care seeking among surgeons with OLBP, this study shows evidence of a significant impact on afflicted surgeons' quality of life as up to 25% of them declared suffering great impact and up to 40% a moderate impact on various life domains including professional achievement, social relationships, psychological well-being and ADLs. Individuals with chronic LBP generally report poorer perceived health status, decreased quality of life, higher incidence of psychological distress and severe bodily pain than the general population which is frequently associated with constraints in professional and social achievement[19].

To Reduce Physical Stress in Operatory Rooms

Unhealthy ergonomic conditions are a well-known characteristic of operating rooms, where surgeons are exposed to several tasks involving uncomfortable movements and postures, such as lifting, bending, twisting, *etc*. This is recognized to increase the risk of musculoskeletal disorders among surgeons as well as other operatory room workers, compared to their peers from other departments[20]. The present study examined the association of eight non-ergonomic movements and postures with OLBP among surgeons, using a scoring model based on the frequency of performing each activity. According to this model, a one-unit increment of the overall score (ORRAS)

is associated with a 6% odd risk of LBP (OR = 1.06). This denotes a probable cumulative effect of non-ergonomic activities; besides eventual specific effects of each risky activity, which will be explored further and presented in another paper.

Role of Back Pain Education

In the present study, having received education to prevent LBP was an independent protective factor against LBP as it reduced the risk by 59%; however, this was only observed among participants who deemed the education as being inadequate. Although this result may seem paradoxical, it may be explained by surgeons who have more frequently experienced LBP being more demanding regarding back education issues. Otherwise, the effectiveness of back education and the relatively recent concept of "back school" in reducing disability and pain among patients with chronic low back pain is thoroughly demonstrated[21]. It was further demonstrated that back school programs contribute in improving quality of life and reducing the psychological impact of LBP[22]. From another view, adapting operating rooms by modern and ergonomic standards and equipment may reduce considerably the physical stress[23].

Regular Physical Activity as a Protective Factor for OLBP

Among the remarkable findings in the present study, regular physical activity being significantly associated with lower prevalence of OLBP was found to be an independent protective factor with approximately 73% less risk (OR = 0.27) with reference to the absence of physical activity. On the other hand, irregular exercise was not demonstrated to reduce OLBP in this study. A systematic review and meta-analysis of 36 prospective cohort studies including 158,475 individuals demonstrated that leisure time physical exercise reduced significantly the risk of chronic LBP by 11% to 16% (OR = 0.89 to 0.84) in a dose-dependent fashion with exercise frequency and intensity[24]. Further, moderate to high leisure time exercise constitutes a protective factor against sciatica and lumbar radicular pain, as evidenced by another meta-analysis carried out by the same authors[25]. On the other hand, it may be hypothesized that intensive physical activity may have detrimental effects on the back and increase the risk of chronic LBP; however, a prospective Norwegian study including 9,616 women and 8,452 men without LBP at baseline confirmed the beneficial effect of physical activity at all intensity levels without evidencing a U-shaped relationship between physical activity intensity and LBP[26]. Additionally, there is extensive evidence supporting the beneficial effect of exercise and physical activity in reducing pain and disability and improving psychological and physical well-being of individuals with chronic back pain, while highlighting the detrimental effects of inactivity in delaying return to normal activity and exacerbating disability and sick leave due to LBP[27]. Therefore, many instances, such as the Royal College of General Practitioners (UK), recommended various physical activities and exercise such as aerobic, muscle strengthening, stretching and postural control among patients with nonspecific LBP, with emphasis on structured exercise programs[28]. Economically, a randomized controlled trial demonstrated that effective exercise among individuals with nonspecific LBP was associated with a yearly cost savings of approximately US$3,200 by patient, compared to normal care, besides a notable gain in quality of life[29]. This highlights the importance of promoting physical exercise among the doctors' community and more specifically surgeons. Medical schools and hospitals should endorse regular physical activity among students, residents and practitioners as a preventive measure to reduce the risk of OLBP and other occupational diseases and improve overall physicians' health within a strategic vision to optimize care quality.

Conclusion

This current study used a double-criterion method to estimate the prevalence of OLBP among Saudi surgeons and found that more than one (55.8%) in two surgeons suffered from this condition. Frequent exposure to intra-occupational risky activities is significantly predictive of OLBP, which demonstrates that the operating room working environment comprises specific harm that should be further identified and corrected. Further, chronic and disabling pain resulting from an occupational disease not only impairs the quality of work life but also impacts the overall quality of life of the individual. On the other hand, findings of this study highlight the protective role of regular physical activity as well as the beneficial effect of back pain education, which indicates the relevance of promoting a healthy lifestyle and ergonomic working conditions.

Conflict of Interest

The authors have no conflict of interest.

Disclosure

The authors did not receive any type of commercial support either in forms of compensation or financial for this study. The authors have no financial interest in any of the products or devices, or drugs mentioned in this article.

Ethical Approval

The study design was reviewed and approved by the Unit of Biomedical Ethics Research Committee at King Abdulaziz University.

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وصف الام أسفل الظهر المهنية بين الجراحين العاملين في مستشفيات وزارة الصحة بجدة :مدى الانتشار، السمات السريرية، المخاطرة وعوامل الحماية

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المستخلص. تم إجراء هذه الدراسة المقطعية لتحديد نسبة انتشار وعوامل المخاطرة المؤدية إلى آلام أسفل الظهر الناتجة عن العمل بين الجراحين العاملين بجميع التخصصات في خمس مراكز طبية رئيسية بمدينة جدة في المملكة العربية السعودية، وذلك من خلال التاريخ المرضي واستكشاف معيارين مميزين للحالة وهما: وقت حدوث الأعراض بعد بداية العمل في الجراحة والتقييم الذاتي لعلاقة آلام أسفل الظهر بالعمل الجراحي. تم جمع وتحليل البيانات المتعلقة بالعوامل المهنية والاجتماعية والديموغرافية وتلك المتعلقة بأنماط الحياة، وأيضاً معلومات عن التاريخ المرضي. أخيرا تم تقييم أثر آلام أسفل الظهر على أربعة أبعاد هي: البعد المهني، الاجتماعي، النفسي، وأنشطة الحياة اليومية. استجاب ٢١٦ جراحاً للاستبيان، منهم ٦٩,٩٪ ذكور بمتوسط أعمار ٣٩ سنة بينما كان وسيط سنوات العمل ٥ سنوات .كان معدل انتشار آلام أسفل الظهر المهنية ٥٥,٨٪ (بمجال ثقة ٩٥٪ يتراوح بين ٤٩,٠٪ إلى ٦٢,٣٪)، وكان ذلك مرتبطاً بمعدلات عالية من العلاج غير الملائم والعلاج الذاتي غير الصحيح مما أدى إلى تأثير ملحوظ على جميع الأبعاد الأربعة.

أظهرت نتائج الانحدار المتعدد المتغيرات عاملين وقائيين هما التدريب البدني المنتظم (نسبة أرجحية ٠,٢٧، مستوى دلالة = ٠,٠٠٢) ووجود مستوى عال للمعرفة بصحة الظهر(نسبة أرجحية ٠,٤١، مستوى دلالة = ٠,٠٣١)، كما أظهرت عاملي مخاطرة لآلام أسفل الظهر المهنية هما شدة التعرض للعوامل الممكن تجنبها في غرفة العمليات(نسبة أرجحية ١,٠٦، مستوى دلالة = ٠,٠٤٨) ووجود ألم مزمن آخر غير ألم الظهر (نسبة أرجحية ٢,٥٩، مستوى دلالة = ٠,٠١٢). يعاني جراح واحد من كل اثنين من آلام أسفل الظهر المهنية، حيث يساهم مستوى التعرض للعديد من العوامل الممكن تجنبها في غرفة العمليات في زيادة خطر التعرض لتلك الآلام. كما برز دور التدريب البدني المنتظم والتثقيف الصحي لصحة الظهر كعاملين وقائيين مهمين.