

The Cost and Diagnostic Value of Back X-Ray in Back Pain

Adel Nasser Al bargi¹, Abdulrahman Ahmed Al naim², Abdullah Khaled Al maqhawi³, Ammar Abdulfattah Al kubaish⁴, Suha Jafar Al Bahrani⁵, Saleh Khaled Al Mogairen⁶, Ibrahim Faris Al ruqi⁷, Sayed Ibrahim Ali⁸, Essam AbdelBary⁹

^{1,2,3,4,5,6,7,8} King Faisal University, College of Medicine, Saudi Arabia

⁹King Faisal University, College of Medicine, Sohag Univeristy, College of Medicine, Egypt

Abstract: To assess the cost and diagnostic value of back X-ray in patient with back pain.

Methods: in form of retrospective cross section study, the self-made data collection instrument was designed with all needed information. The study cover all patient with back pain went for X-ray with CT scan or M.R.I in one year duration started from July 2012 to July 2013 in National Guard Hospital. The data is collected from medical files in the medical record for total 295 patients. The collected data were statistically analyzed.

Results: Regarding radiology requests for assessment of back pain, X-ray plus MRI was frequently requested in the majority of cases (90.2%). Most patients were had a single request, while those requiring repeated requests were 8.5% for two requests, 1.0% and 0.3% for three or four requests.

Out of the total requested, back X-ray yielded 28.1% abnormalities in comparison with MRI and CT scan which yielded a positive diagnosis in 88.5% and 79.3% of cases; respectively. In this regards, in comparison with MRI, and CT scan back X-ray was able to detect 3 out of every 10 diagnosis for back pain while MRI and CT scan was able to detect diagnosis in 9 out of 10 and 8 out of 10; respectively in cases with back pain. Among those who had done the back X-ray for back pain together with CT scan; the proportion of back X-ray there a frequency of 78.6% mismatch with abnormal CT scan done for back pain. On the other hand regarding the back X-ray which was done together with M.R.I for back pain; the back X-ray mismatch frequency with abnormal M.R.I amounted to (96.8%). The cost of x-ray requested in addition to M.R.I was the highest amounting to almost SR 700,000.

Conclusion: back X-ray fails to detect abnormality in most of cases in compare with CT scan and M.R.I. it is lead to more cost and more radiation exposure and work load. so, generally it is not recommended. The clinical assessment is mandatory to evaluate the patient and request the proper form of radiology. Lumbosacral X-ray shows to be costly with minimum diagnostic value and high radiation exposure. Patient satisfaction should be reached by proper communication and trust with patient with detailed education rather than non-clinically indication for X-ray referral.

Keywords: Back pain, X-ray, CT MRI, Saudi Arabia.

I. INTRODUCTION

Low back pain (LBP) is any back pain between the ribs and the top of the leg, from any cause. Low back pain is an important public health problem. (1)Low back pain is an extremely common problem that most people experience at some point in their life. (2)Low back pain was shown to be a major problem throughout the world, with the highest prevalence among female individuals and those aged 40-80 years. After adjusting for methodological variation, the mean \pm prevalence was estimated to be $11.9 \pm 2.0\%$. (3).

Aim: The aim of this study is to improve the clinical practice regarding the request of back X-ray in patient with back pain and to know is it recommend for diagnosis or not? Also this study is aiming to be cost effectiveness and minimize the radiation exposure to the patient.

II. METHODOLOGY

Study setting: The study had done in king Abdul-Aziz Medical City for National Guard in Al-Ahsa, Eastern region, Kingdom of Saudi Arabia. The study covers the duration from July1, 2012to July 31,2013.

Study design: It is an observational study in form of Cross Section study.

Sampling: The study population is the total number of patients with back pain who are visiting King Abdul-Aziz Medical City in AL-Ahsa in the duration starting from 1st if July 2012 to 31st of July 2013 who had done the radiological investigation with X-ray in addition to CT and/ or M.R.I.

It is done in the form of total comprehensive sample for the total patients, which count 295 patients from different age groups and different gender.

Data Entry and Analysis: The collected data is entered to a personal computer and analyzed by using Statistical Package for the Social Science (SPSS) version 20.

III. RESULTS

Demographic Characteristics:

Out of the sample of 295 subjects the majority (69.5%) were in the age group 35 – 64 years. On the other hand, males and females were of almost equal proportions, being 49.2% and 50.8%; respectively, (Table 1).

TABLE 1: DEMOGRAPHIC CHARACTERISTICS (N=295)

Variable	Number (%)
Age:	
10 – 34	42 (14.2)
35 – 64	205 (69.5)
65 +	48 (16.3)
Gender:	
Males	145 (49.2)
Females	150 (50.8)

Frequency of X-ray requests:

Regarding radiology requests for assessment of back pain, X-ray plus MRI was frequently requested in the majority of cases (90.2%). Most patients were had a single request, while those requiring repeated requests were 8.5% for two requests, 1.0% and 0.3% for three or four requests (Table 2).

TABLE 2: FREQUENCY OF BACK X-RAY REQUESTS (N=295)

Request	Number (%)
<i>Combinations of radiological requests:</i>	
X-ray plus CT scan	16 (5.4)
X-ray plus MRI	266 (90.2)
X-ray plus CT scan Plus MRI	13 (4.4)
<i>Number of back X-ray requested:</i>	
1	266 (90.2)
2	25 (8.5)
3	3 (1.0)
4	1 (0.3)

X-ray, CT scan and MRI findings:

Table 4 shows the diagnostic findings in cases with back pain when assessed by back X-ray, CT scan and MRI. Out of the total requested, back X-ray yielded 28.1% abnormalities in comparison with MRI and CT scan which yielded a positive diagnosis in 88.5% and 79.3% of cases; respectively. In this regards, in comparison with MRI, and CT scan back X-ray was able to detect 3 out of every 10 diagnosis for back pain while MRI and CT scan was able to detect diagnosis in 9 out of 10 and 8 out of 10; respectively in cases with back pain (Table 3)

TABLE 3: BACK X-RAY, CT SCAN AND MRI FINDINGS (N=295)

Finding	X-ray Number (%)	MRI Number (%)	CT Scan Number (%)
Abnormal finding	83 (28.1)	247 (88.5)	23 (79.3)
Normal Findings	212 (71.9)	32 (11.5)	6 (20.7)
Total	295 (100.0)	279 (100.0)	29 100.0)

Variability of back X-ray abnormality with demographic variables:

The diagnostic finding of back X-ray for back pain in relation with demography shows that there were significantly more abnormal findings in the age group 35-64 (64.3%), $p < 0.00$; while gender differences did not show significant variation. (Tables 4 and 5)

TABLE 4: VARIABILITY OF ABNORMAL BACK X-RAY WITH AGE (N=295)

Radiological finding of X-ray				
Age Group (years)	Normal Number (%)	Abnormal Number (%)	Total Number (%)	P-value
10 – 34	29 (69.0)	27 (64.3)	42 (100.0)	0.004
35 – 64	150 (73.2)	55 (26.8)	205 (100.0)	
65+	33 (78.8)	15 (31.2)	48 (100.0)	

TABLE 5: VARIABILITY OF ABNORMAL BACK X-RAY WITH GENDER (N=295)

Radiological finding of X-ray				
Gender	Normal Number (%)	Abnormal Number (%)	Total Number (%)	P-value
Males	111(76.6)	34 (23.4)	145 (100.0)	0.92
Females	101(67.3)	49 (32.7)	150 (100.0)	

Matching of back X-ray with CT scan and M.R.I with demography:

From total back X-ray which done for back pain in comparison with CT scan or M.R.I radiological finding; the proportion of mismatching is significantly high in age group between 35-64 years ($P < 0.004$) (Table 6).

TABLE 6: VARIABILITY OF BACK X-RAY MATCHING WITH CT SCAN OR M.R.I WITH AGE (N=295)

Radiological finding of X-ray				
Age Group (years)	Not Matching Number (%)	Matching Number (%)	Total Number (%)	P-value
10 – 34	15 (35.7)	27 (64.3)	42 (100.0)	0.004
35 – 64	143 (69.8)	62 (30.2)	205 (100.0)	
65+	32 (66.7)	16 (33.3)	48 (100.0)	

However, in relation with gender it was found that the proportion of back X-ray showing a mismatch with CT scan or M.R.I did not show a significant variation. (Table 7)

TABLE 7: VARIABILITY OF X-RAY MATCHING WITH CT SCAN OR M.R.I BASED ON GENDER (N=295)

Radiological finding of X-ray				
Gender	Normal Number (%)	Abnormal Number (%)	Total Number (%)	P-value
Males	90 (62.)	55 (37.9)	145 (100.0)	0.92
Females	100 (66.7)	50 (33.3)	150 (100.0)	

Radiological finding of back X-ray with numbers of request:

Repeated lumbo-sacral X-rays for back pain, in comparison with single ones did not show significant variation in detecting abnormalities in case of back pain. (Table 8)

TABLE 8: NUMBER OF X-RAY REQUEST WITH X-RAY RESULT (N=295)

Radiological finding of X-ray					
Back request	X-ray	Normal Number (%)	Abnormal Number (%)	Total Number (%)	P-value
One X-ray		195 (73.3)	71 (26.7)	266 (100.0)	0.126
More than one		17 (58.6)	12 (41.4)	29 (100.0)	

Cost of back pain radiography:

In those who had back pain and visiting the hospital at the time of study, the cost is highest is case of M.R.I requests, which cost 2,400 Saudi Riyals per each request. The CT scans 1300 Saudi Riyals while back X-ray cost 180 Saudi Riyals only.

The most frequent radiological request for back pain is X-ray and M.R.I, which cost a total of 686,280 Saudi Riyals. (Table 9)

Tables 9, 10,11 and 12 show the frequency and cost of each radiological request for back pain. It shows also that most patients had a single request. The cost of x-ray requested in addition to M.R.I was the highest amounting to almost SR 700,000.

TABLE 9: DISTRIBUTION OF TOTAL COST BY RADIOLOGY TYPE (N=295)

Radiography	Cost (*SR)
X-ray plus CT scan	23,680
X-ray plus M.R.I	686,280
X-ray plus CT plus M.R.I	50,440

*Saudi Riyals

TABLE 10: DISTRIBUTION OF BACK X-RAY COST BY NUMBER OF REQUEST (N=295)

Number of requests	Cost of X-ray (*SR)	Number (%)
1	180	266 (90.2)
2	360	25 (8.5)
3	540	3 (1.0)
4	720	1 (0.3)

*Saudi Riyals

TABLE 11: DISTRIBUTION OF CT REQUESTED COST BY NUMBER OF REQUEST (N29)

Number of requests	Cost of CT scan (*SR)	Number (%)
1	1,300	26 (89.7)
2	2,600	3 (10.3)

*Saudi Riyals

TABLE 12: DISTRIBUTION OF M.R.I REQUESTED COST BY NUMBER OF REQUEST (N=279)

Number of requests	Cost of M.R.I (SR)*	Number (%)
1	2,400	264 (94.6)
2	4,800	14 (5.0)
3	7,200	1 (0.4)

*Saudi Riyals

IV. DISCUSSION

Demographic characteristics: Among those who went for back X-ray for back pain in the study period, the mean age of the patients involved is 50.5 with only 14.2% aged 34 or below. This is in keeping with findings of Secer et al.⁽⁵⁾ who reported that low back pain was most commonly seen in people aged between 30-50 years. The study showed that the

proportions of males and females were almost equal. This is not usual because the prevalence of back pain is higher in female usually in our region. ^(3,4,5) This could be due to a sampling bias.

Associated Co morbidities: Low back pain can be a result of morbidities. Based on that, increasing in the weight, measured by body mass index, is mainly associated with back pain ^(5,18, 19, 20, 21), which was supported also by this study.

The main weight abnormality observed in this study, which is associated with back pain, is obesity and morbid obesity, which was observed in more than half of patients involved. This is because the prevalence of obesity is high in Saudi Arabia as revealed by previous studies. ^(27,28,29) So, it is better to control weight prevent and to improve the symptoms from back pain.

The study shows that the majority of people with back pain have the pain for more than three months duration. It goes with other studies that most case present with chronic pain rather than acute. ^(7, 9, 11, 12, 13)

Vitamin D deficiency found in 21% among those who have the back pain, but in general there is positive association of vitamin D deficiency with a variety of nonspecific bone pain. ⁽²²⁾ More studies with larger samples are required to confirm these findings

Radiological request and frequency: Lumber spine radiographic examination is the third most frequent radiographic procedure performed and delivers the highest population dose of ionizing radiation of any radiodiagnostic procedure. ⁽¹⁶⁾ Approximately one-quarter of patients 18 to 50 years of age with acute low back pain who received imaging tests had no identifiable indication for imaging. ⁽²⁵⁾ Generally, because the majority of back pain duration is more than three months, the physician decides to request combination of lumbosacral X-ray and M.R.I in most cases. In this study, back X-ray was able to detect 3 out of every 10 diagnosis for back pain in compare with CT scan and M.R.I for the back which able to detect 8 out of 10 and 9 out of 10; respectively and most patient had a single request only.

In compare with the other study, back X-ray is the first radiological request by the general practitioner ^(8, 24) However, advanced imaging such as CT scan and M.R.I is increasing in the request by physician for back pain. In one study done in the United States shows there was a strong secular trend in use of advanced imaging; patients were nearly 3 times as likely to receive a CT or MRI as they were 4 years earlier. ⁽⁶⁾

Back X-ray finding with demographic variables: In all age groups and in both gender the majority of radiological result of lumbosacral X-ray done for back pain patients does not show any abnormality. For that it is not recommended to detect the abnormality. Plain radiographs infrequently detect findings that change management, but often detect findings unrelated to symptoms. ⁽¹¹⁾ For that, clinical assessment is highly recommended more than radiological request. ^(14,15,17,23)

Lumbosacral X-ray matching with CT scans and M.R.I based on demography:

Radiological finding of back X-ray with numbers of request: The most commonly ordered spinal imaging test is X-ray because of ready availability and low cost. Most of the lumbosacral radiological finding is normal either in one request by physician or multiple repeated requests. So depending on that, it is recommended to the physician not to repeat the lumbosacral request because it has no benefit from repetition.

V. CONCLUSION

Back X-ray fails to detect abnormality in most of cases in compare with CT scan and M.R.I. it is lead to more cost and more radiation exposure and work load, so, generally it is not recommended. The clinical assessment is mandatory to evaluate the patient and request the proper form of radiology. Lumbosacral X-ray shows to be costly with minimum diagnostic value and high radiation exposure. Patient satisfaction should be reached by proper communication and trust with patient with detailed education rather than non-clinically indication for X-ray referral.

REFERENCES

- [1] Loney PL, Stratford PW. The prevalence of low back pain in adults: a methodological review of the literature. *Phys Ther.* 1999 Apr; 79(4):384-96. Review. PubMed PMID: 10201544.
- [2] Hoy D, Brooks P, Blyth F, Buchbinder R. the Epidemiology of low back pain. *Best Pract Res Clin Rheumatol.* 2010 Dec;24(6):769-81. doi: 10.1016/j.berh.2010.10.002. Review. PubMed PMID: 21665125.

- [3] Hoy D, Bain C, Williams G, March L, Brooks P, Blyth F, Woolf A, Vos T, Buchbinder R. A systematic review of the global prevalence of low back pain. *Arthritis Rheum.* 2012 Jun;64(6):2028-37. doi: 10.1002/art.34347. Epub 2012 Jan 9. Review. PubMed PMID: 22231424.
- [4] Bener A, Dafeeah EE, Alnaqbi K, Falah O, Aljuhaisi T, Sadeeq A, Khan S, Schlogl J. An epidemiologic analysis of low back pain in primary care: a hot humid country and global comparison. *J Prim Care Community Health.* 2013 Jul 1;4(3):220-7. doi: 10.1177/2150131913479385. Epub 2013 Feb 19. PubMed PMID: 23799711.
- [5] Al-Arfaj AS, Al-Saleh SS, Alballa SR, Al-Dalaan AN, Bahabri SA, Al-Sekeit MA, Mousa MA. How common is back pain in Al-Qaseem region. *Saudi Med J.* 2003 Feb;24(2):170-3. PubMed PMID: 12682682.
- [6] Friedman BW, Chilstrom M, Bijur PE, Gallagher EJ. Diagnostic testing and treatment of low back pain in United States emergency departments: a national perspective. *Spine (Phila Pa 1976).* 2010 Nov 15;35(24).
- [7] Kendrick D, Fielding K, Bentley E, Kerslake R, Miller P, Pringle M. Radiography of the lumbar spine in primary care patients with low back pain: randomised controlled trial. *BMJ.* 2001 Feb 17;322(7283):400-5
- [8] Rynänen OP, Lehtovirta J, Soimakallio S, Takala J. General practitioners' willingness to request plain lumbar spine radiographic examinations. *Eur J Radiol.* 2001 Jan;37(1):47-53.
- [9] Kvistad KA, Espeland A. [Diagnostic imaging in neck and low back pain]. *Tidsskr Nor Laegeforen.* 2010 Nov 18;130(22):2256-9.
- [10] Chou R, Fu R, Carrino JA, Deyo RA. Imaging strategies for low-back pain: systematic review and meta-analysis. *Lancet.* 2009 Feb 7;373(9662):463-72.
- [11] Van Tulder MW, Assendelft WJ, Koes BW, Bouter LM. Spinal radiographic findings and nonspecific low back pain. A systematic review of observational studies. *Spine (Phila Pa 1976).* 1997 Feb 15;22(4):427-34.
- [12] Kerry S, Hilton S, Patel S, Dundas D, Rink E, Lord J. Routine referral for radiography of patients presenting with low back pain: is patients' outcome influenced by GPs' referral for plain radiography? *Health Technol Assess.* 2000;4(20):i-iv, 1-119.
- [13] Jarvik JG, Deyo RA. Diagnostic evaluation of low back pain with emphasis on imaging. *Ann Intern Med.* 2002 Oct 1;137(7):586-97.
- [14] Pillastrini P, Gardenghi I, Bonetti F, Capra F, Guccione A, Mugnai R, Violante FS. An updated overview of clinical guidelines for chronic low back pain management in primary care. *Joint Bone Spine.* 2012 Mar;79(2):176-85.
- [15] Schroth WS, Schectman JM, Elinsky EG, Panagides JC. Utilization of medical services for the treatment of acute low back pain: conformance with clinical guidelines. *J Gen Intern Med.* 1992 Sep-Oct;7(5):486-91.
- [16] Vader JP, Terraz O, Perret L, Aroua A, Valley JF, Burnand B. Use of and irradiation from plain lumbar spine radiography in Switzerland. *Swiss Med Wkly.* 2004 Jul 24;134(29-30):419-22.
- [17] Cheng JS, Lee MJ, Massicotte E, Ashman B, Gruenberg M, Pilcher LE, Skelly AC. Clinical guidelines and payer policies on fusion for the treatment of chronic low back pain. *Spine (Phila Pa 1976).* 2011 Oct 1;36(21 Suppl):S144-63.
- [18] Leboeuf-Yde C, Kyvik KO, Bruun NH. Low back pain and lifestyle. Part II--Obesity. Information from a population-based sample of 29,424 twin subjects. *Spine (Phila Pa 1976).* 1999 Apr 15; 24 (8):779-83; discussion 783-4.
- [19] Chowdhury D, Sarkar S, Rashid MH, Rahaman A, Sarkar SK, Roy R. Influence of body mass index on low back pain. *Mymensingh Med J.* 2014 Jan;23(1):125-9. PubMed PMID: 24584385.
- [20] Heuch I, Heuch I, Hagen K, Zwart JA. Body mass index as a risk factor for developing chronic low back pain: a follow-up in the Nord-Trøndelag Health Study. *Spine (Phila Pa 1976).* 2013 Jan 15;38(2):133-9. doi: 10.1097/BRS.0b013e3182647af2. PubMed PMID: 22718225.
- [21] Heuch I, Hagen K, Heuch I, Nygaard Ø, Zwart JA. The impact of body mass index on the prevalence of low back pain: the HUNT study. *Spine (Phila Pa 1976).* 2010 Apr 1;35(7):764-8. doi: 10.1097/BRS.0b013e3181ba1531. PubMed PMID: 20228714.

- [22] Heidari B, Shirvani JS, Firouzjahi A, Heidari P, Hajian-Tilaki KO. Association between nonspecific skeletal pain and vitamin D deficiency. *Int J Rheum Dis*. 2010 Oct;13(4):340-6. doi: 10.1111/j.1756-185X.2010.01561.x. Epub 2010 Aug 16. PubMed PMID: 21199469.
- [23] Chou R, Qaseem A, Snow V, Casey D, Cross JT Jr, Shekelle P, Owens DK; Clinical Efficacy Assessment Subcommittee of the American College of Physicians; American College of Physicians; American Pain Society Low Back Pain Guidelines Panel. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med*. 2007 Oct 2;147(7):478-91. Erratum in: *Ann Intern Med*. 2008 Feb 5;148(3):247-8. PubMed PMID: 17909209
- [24] Suarez-Almazor ME, Belseck E, Russell AS, Mackel JV. Use of lumbar radiographs for the early diagnosis of low back pain. Proposed guidelines would increase utilization. *JAMA*. 1997 Jun 11;277(22):1782-6. PubMed PMID: 9178791.
- [25] National Committee for Quality Assurance. The state of health care quality 2006. Available at: www.ncqa.org (Accessed on October 11, 2011)
- [26] Secer, M., Muradov, J.M., and Dalgic A. Evaluation of congenital lumbosacral malformations and neurological findings. *Turkish Neurosurgery*, 2009; 19(21):145-148.
- [27] Ng SW, Zaghoul S, Ali HI, Harrison G, Popkin BM. The prevalence and trends of overweight, obesity and nutrition-related non-communicable diseases in the Arabian Gulf States. *Obes Rev*. 2011 Jan;12(1):1-13. doi: 10.1111/j.1467-789X.2010.00750.x. Review. PubMed PMID: 20546144.
- [28] Al-Nozha MM, Al-Mazrou YY, Al-Maatouq MA, Arafah MR, Khalil MZ, Khan NB, Al-Marzouki K, Abdullah MA, Al-Khadra AH, Al-Harathi SS, Al-Shahid MS, Al-Mobeireek A, Nouh MS. Obesity in Saudi Arabia. *Saudi Med J*. 2005 May;26(5):824-9. PubMed PMID: 15951877.
- [29] al-Nuaim AR, al-Rubeaan K, al-Mazrou Y, al-Attas O, al-Daghari N, Khoja T. High prevalence of overweight and obesity in Saudi Arabia. *Int J Obes Relat Metab Disord*. 1996 Jun;20(6):547-52. PubMed PMID: 8782731.