

Evaluation of disability of occupational illness claims for workers' compensation

Sultan T. Al-Otaibi, FFCM (KFU) FRCPC.

ABSTRACT

Occupational physicians are faced with the challenge of estimating the contribution of occupational and non-occupational risk factors to a particular work-related illness for workers' compensation. This paper proposes guidelines for occupational physicians to evaluate claims for presentation to a compensation board. Occupational bladder cancer was taken as an example. Relevant literature was obtained and reviewed. A worksheet was designed to record pertinent information on occupational illness. The procedure for handling a claim is described. Failure to follow such an approach may lead to gross inequities.

Saudi Med J 2004; Vol. 25 (2): 145-149

Workers are subjected to occupational illnesses and injuries during the course of their employment as a result of exposure to work hazards. In Europe, legislation used was established in the eighteenth century requiring employers to compensate the injured worker. To date most countries all over the world has a Workmen's Compensation Board (WCB). In Saudi Arabia, most of the employees are covered by the General Organization for Social Insurance (GOSI), which became effective from May 1, 1982. However, a lesser number of employees working in shops or small establishments are covered under Saudi Labor Law of 1998. Prior to the inception of GOSI, the entire workforce was governed under the Labor regulations of 1947. Compensation includes medical care, and temporary total disability benefit (injured worker unable to work on a temporary basis; hence, they are entitled to receive 100% of their daily wage through GOSI).¹

On the other hand, the injured worker may receive permanent total disability (PTD). Permanent total disability defined as the injured worker is unable to do any meaningful work on permanent basis; hence they are entitled to receive

100% of the basic salary.¹ Occupational physicians are faced with the challenge of estimating the contribution of occupational and non-occupational risk factors to a particular work-related illness. This situation arises when workers' compensation is involved. The objective of this paper is to propose a format to find out the causality of occupational illness in a particular case. In this paper, occupational bladder cancer is taken as an example. Urinary bladder cancer constitutes 2% of all malignant tumors.² Bladder cancer can be attributed to both occupational and non-occupational causes. It is estimated that 20% of bladder cancer patients were due to occupational causes.^{3,4} Over 90% of bladder cancers are transitional cell type, approximately 6-8% are squamous cell type, and the remainder is adenocarcinomas. The most common presenting symptom of bladder cancer is painless hematuria, which accounts for 80% of cases. Other symptoms include abdominal pain, mass, increased urinary frequency, dysuria, urgency and nocturia. The definitive diagnosis of bladder cancer is made by cystoscopy and biopsy of the suspicious area.^{4,6} No bladder cancer study appears complete without an estimate of the relative contributing risk factors

From the Department of Medical Operations, Preventive Medicine Services Division, Occupational Medicine Section, Saudi Aramco Medical Services Organization, Saudi Aramco, Dhahran, Kingdom of Saudi Arabia.

Address correspondence and reprint request to: Dr. Sultan Al-Otaibi, Saudi Aramco Medical Services Organization, Saudi Aramco, PO Box 11606, Dhahran 31311, Kingdom of Saudi Arabia. Tel. +966 (3) 8778506. Fax. +966 (3) 8778841. E-mail: otaibist@aramco.com.sa

for bladder cancer in non-occupational compared to the occupational ones.

Non-occupational risk factors include a) age - the incidence of bladder cancer increases with age; being more common in the 60-70 age group. The diagnosis of urinary bladder cancer is rare below the age of 45. Cases of bladder cancer below the age of 50 should raise the suspicion of an occupational relationship;^{7,9} b) gender - the male to female ratio is 3:1. This difference in gender can be explained by increased smoking and occupational exposure among men;^{4,9} c) family history of bladder cancer-cytogenic abnormalities involving chromosomes 1, 5, 7, 9 and 11 have been identified with bladder cancer. Furthermore, the gene expression of "ras" correlates with the prognosis and histological grade of bladder cancer.^{2,4} Two of the enzymes involved in the detoxification of arylamine, glutathione S-transferase Mu and N-acetyltransferase, are genetically controlled;¹⁰ d) smoking - this is the most important known cause of bladder cancer in men and women. Thirty-nine to seventy-eight percent of bladder cancer is attributed to smoking.¹¹ The relative risk of bladder cancer among smokers is twice that of nonsmokers.¹² Cigarettes have been found to contain several bladder carcinogens which include: beta-naphthylamine, aminostilbene, o-nitrotoluene, dimethylnitrosamine, aminofluorine, o-toluidine, and di-n-butyl nitrosamine. The presence of these carcinogens has been reported in animal tests as organ specific, and which is capable of producing tumors in the bladder;¹³ e) recurrent renal stones - these have been implicated as causes of bladder cancer in epidemiological studies. The type of bladder cancer resulting from recurrent renal calculi is squamous cell type;^{3,4} f) recurrent upper urinary tract infection - schistosomiasis has been reported to cause squamous cell carcinoma of the urinary bladder, and there is evidence that other urinary tract infections may increase the risk of bladder cancer;^{3,6} g) analgesic abuse - excessive ingestion of analgesic agents containing phenacetin increases the risk of transitional cell carcinoma of the urinary bladder;^{2,3,5,6} h) cyclophosphamide usage - a long-term administration of cyclophosphamide has been found to increase the risk of bladder cancer. Cyclophosphamide is metabolized to acrolein and phosphoramidate, and both are incriminated in the causation of bladder cancer;^{4,14} i) hair dye usage - Occupational exposure to hair dyes by hairdressers, barbers and beauticians are associated with increased risk of bladder cancer. The relative risk was estimated to be 1.4 (183 observed versus 129 expected). Recent epidemiological review concluded there was no association between modern hair dye exposure and bladder cancer;¹⁵ j) others - alcohol, excessive coffee drinking and use of artificial sweeteners has been reported, in some

epidemiological studies, to increase the risk of bladder cancer. However, these studies have methodological problems, which are biased and confounding in nature. Indeed, a recent critical review of the literature did not find any strong evidence for these associations.^{14,16}

Occupational risk factors include chemicals reported by International Agency for Research on Cancer (IARC)^{16,17} as bladder carcinogens as follows: a) Known bladder carcinogens - naphthylamine (alpha and beta), benzidine, 4-aminobiphenyl. b) Probable/suspected bladder carcinogens - benzidine - based dyes, p-chloro-o-toluidine, 4,4-methylene-bis(2-chloroaniline), c) Possible bladder carcinogens-auramine, ortho-toluidine, 4,4-methylene-bis(2-methylaniline), orthonitrotoluene, 3,3-dichlorobenzidine, 3,3-dimethoxybenzidine.

The following industrial processes were found to be associated with an increased risk of bladder cancer.^{2,18-29} a) Rubber industry - there is an increased risk of bladder cancer in the rubber industry from exposure to aromatic amines. In addition, exposure to Argerite white in these workers has reportedly been associated with bladder cancer. Argerite white contains beta-naphthylamine in small quantities ranging from 20-50 ppm. b) Coal gasification - these workers have an increased risk of bladder cancer as a result of exposure to polycyclic aromatic hydrocarbons (PAH). c) Magenta manufacture - there is an increased risk from exposure to magenta precursors, such as orthotoluidine. d) Leather workers - these workers have an increased risk for bladder cancer from exposure to chlornaphazine. e) Drill press operators - there is an increased risk from exposure to methylene-dianiline. f) Petroleum workers and hairdressers - exposure to phenacetin-containing compounds results in an increased risk of bladder cancer. The latency period between the initial occupational exposure and the development of bladder cancer is quite variable with a mean of 20 years, and range of 4-40 years.^{30,31} When there is exposure to more than one carcinogen, such as smoking and an occupational carcinogen, both exposures may contribute to the development of urinary bladder cancer.

The investigator obtained relevant literature on bladder cancer through a Medline search. Information on bladder cancer was also located in bibliographic data bases such as Toxline, Toxnet, NIOSHTIC, Chemical Carcinogenesis Research Information System, containing information on mutagenicity and carcinogenicity 'on line'. The literature on bladder cancer was reviewed. An appropriate methodology was chosen after careful review of the available literature. A worksheet was designed to record pertinent information about bladder cancer (**Appendix 1**).

Procedure for handling bladder cancer claims. Work related bladder cancer claims are referred to the workers' compensation board. When occupational physicians were asked to estimate the contribution of occupational and non-occupational risk factors of bladder cancer, the following points were noted: The relevant medical history of the injured worker should be obtained and the diagnosis must be verified. A detailed lifetime work history and job description should be obtained for each job held. Work exposures should be determined through breakdown of all possible chemicals of concern by product names, manufacturers' and Material Safety Data Sheet, any available government reports, and industrial hygiene data. The appropriate latency period should also be estimated. Non-occupational and occupational risk factor should be determined by reviewing the claim. The relative contributions of each of the risk factors are based on the available scientific evidence in conjunction with the exposure assessment. A decision should be made to either accept or reject the claim. A problem arises when there is a gray area in relation to the contribution of occupational factors that are not well documented in the literature, or the exposure assessment is not clear. In such cases, the medical opinion is rendered to the adjudicator after careful and critical review of the literature. In this case, the probability of each risk factor for bladder cancer, either occupational (for example aromatic amines), or non-occupational (for example smoking), can be estimated from the relative risk of each risk factor using a formula proposed in previous papers.^{32,33} The etiologic fraction among exposed (EFE) can thus be calculated for each independent risk factor, and these values can then be estimated to facilitate the evaluation of the claim. Causality is not determined based on epidemiological studies only. The Bradford Hill criteria are used to determine causality.

Limitations of cancer evaluation. 1) Methods of assessing carcinogenicity and principles of epidemiological studies are not meant to apply for assessment of individual cases. 2) Occasionally there are incomplete records of work exposure, especially in cancer with a long latency period. For example, records of previous employers are not available or no longer exist. 3) There may be limited or insufficient data on the carcinogenicity of a particular exposure. 4) There are controversial issues regarding the role of endogenous mutagens in carcinogenicity, and the threshold level and dose of exposure in the causation of occupational carcinogens.

Although the development of approach to evaluate a claim of bladder cancer can be complex, failure to follow such a planned approach may lead

to gross inequity. I hope that this work in this area will assist occupational physicians to evaluate cases of occupational bladder cancer. Indeed, the same principles could apply to evaluate any work-related illness. On the other hand, occupational bladder cancer is clearly linked to specific exposure and is amenable to prevention. The occurrence of occupational bladder cancer should serve as a sentinel health event, which should signal the need to reexamine preventive practices in the workplace.

Further research, such as meta-analysis or epidemiological studies, is needed for the proper assessment of occupational and non-occupational risk factors for bladder cancer. A formulation of workers' compensation decision rules, or guidelines for work-related illnesses, may be considered in future projects.

References

1. Regulations for rules and procedures for implementation of the occupational hazards branch and implementing decisions. 1st ed. Riyadh (KSA): General Organization for Social Insurance; 1984 (1404 Hijra). p. 1-60.
2. LaDou J. Occupational and Environmental Medicine. 2nd ed. Stamford, Conn: Appleton and Lange; 1997. p. 571-583.
3. Bang KM. Epidemiology of occupational cancer. *Occup Med* 1996; 11: 467-485.
4. Johansson SL, Cohen SM. Epidemiology and etiology of bladder cancer. *Semin Surg Oncol* 1997; 13: 291-298.
5. Leung HY, Griffiths TR, Neal DE. Bladder cancer. *Postgrad Med J* 1996; 72: 719-724.
6. Shirai T. Etiology of bladder cancer. *Semin Urol* 1993; 11: 113-126.
7. Frumin E, Velez H, Bingham E, Gillen M, Braithwaite M, LaBarck R. Occupational bladder cancer in textile dyeing and printing workers: six cases and their significance for screening programs. *J Occup Med* 1990; 32: 887-890.
8. Parkes H, Evans A. Chemical carcinogen. *American Chemical Society Monographs* 1984; 182: 277-301.
9. Matanoski GM, Elliott EA. Bladder cancer epidemiology. *Epidemiol Rev* 1981; 3: 203-229.
10. Ross RK, Jones PA, Yu MK. Bladder cancer epidemiology and pathogenesis. *Semin Urol* 1996; 23: 536-545.
11. Miller AB. The etiology of bladder cancer from the epidemiological viewpoint. *Cancer Res* 1977; 37: 2939-2942.
12. Brownson RC, Chang JC, Davis JR. Occupation, smoking, and alcohol in the epidemiology of bladder cancer. *Am J Pub Health* 1987; 77: 1298-1300.
13. Silverman DT, Morrison AS, Devesa SS. Bladder cancer. In: Schottenfeld D, Fraumeni JF, editors. *Cancer Epidemiology and Prevention*. 2nd ed. New York, Oxford University Press; 1996. p. 1156-1179.
14. Shirai T, Fradet Y, Huland H, Bollack C, Droller M, Janknegt R et al. The etiology of bladder cancer, are there any new clues or predictors of behavior? *Int J Urol* 1995; 2 Suppl 2: 64-75.
15. La Vecchia C, Tavani A. Epidemiological evidence on hair dyes and the risk of cancer in humans (Review). *Eur J Cancer Prev* 1995; 4: 31-43.
16. International Agency for Research on Cancer (IARC). Aniline. IARC monographs. Suppl 7. Lyon (FR): IARC; 1987. p. 99.

17. International Agency for Research on Cancer (IARC). Aniline and aniline hydrochloride. IARC monographs. Vol 27. Lyon (FR): IARC; 1982. p. 39.
18. Anton-Culver H, Lee-Feldstein A, Taylor TH. Occupation and bladder cancer risk. *Am J Epidemiol* 1992; 136: 89-94.
19. Kogevians M, Sala M, Boffetta P, Kazerouni N, Kromhout H, Hoar-Zahm S. Cancer risk in the rubber industry: a review of the recent epidemiological evidence. *Occup Environ Med* 1998; 55: 1-12.
20. Dolin PJ. A descriptive study of occupation and bladder cancer in England and Wales. *Br J Cancer* 1992; 65: 476-478.
21. Hours M, Dananche B, Fevotte J, Bergeret A, Ayzac L, Cardis E et al. Bladder cancer and occupational exposures. *Scand J Work Environ Health* 1994; 20: 322-330.
22. La Vecchia C, Negri E, D'Avanzo B, Franceschi S. Occupation and the risk of bladder cancer. *Int J Epidemiol* 1990; 19: 264-268.
23. Gonzalez CA, Lopez-Abente G, Errezola M, Escola A, Riboli E, Izarzugaza I et al. Occupation and bladder cancer in Spain: a multi-centre case-control study. *Int J Epidemiol* 1989; 18: 569-577.
24. Clavel J, Mandereau L, Limasset JC, Hemon D, Cordier S. Occupational exposure to polycyclic aromatic hydrocarbons and the risk of bladder cancer: A French case-control study. *Int J Epidemiol* 1994; 23: 1145-1153.
25. Siemiatycki J, Dewar R, Nadan L, Gerin M. Occupational risk factors for bladder cancer: results from a case-control study in Montreal, Quebec, Canada. *Am J Epidemiol* 1994; 140: 1061-1080.
26. Silverman DT, Levin LI, Hoover RN, Hartge P. Occupational risk of bladder cancer in the United States: I. White men. *J Natl Cancer Inst* 1989; 81: 1472-1480.
27. Schoenberg J, Stemhagen A, Mogielnicki AP, Altman R, Abe T, Mason TJ. Case-control study of bladder cancer in New Jersey. 1. Occupational exposures in white males. *J Natl Cancer Inst* 1984; 72: 973-981.
28. Liss G, Guirguis S. Follow up of a group workers intoxicated with 4,4-methylenedianiline. *Am J Ind Med* 1994; 26: 117-124.
29. Smith EM, Miller ER, Woolson RF, Brown CK. Bladder cancer risk among auto and truck mechanics and chemically related occupations. *Am J Public Health* 1985; 75: 881-883.
30. Schulte PA, Ringen K, Hemstreet GP. Optimal management of asymptomatic workers at high risk of bladder cancer. *J Occup Med* 1986; 28: 13-17.
31. Goldsmith DF. Calculating cancer latency using data from a nested case-control study of prostatic cancer. *J Chronic Dis* 1987; 40 Supp 2: 119S-123S.
32. Enterline P. Asbestos and lung cancer. Attributability in the face of uncertainty. *Chest* 1980; (Suppl 2) 78:377-379.
33. Chase GR, Kotin P, Crump K, Mitchell RS. Evaluation for compensation of asbestos-exposed individuals. II. Apportionment of risk for lung cancer and mesothelioma. *J Occup Med* 1985; 27: 189-198.

Appendix 1
Bladder cancer worksheet

Claim number: _____ Date of claim: _____

Employer (Industry): _____

Job title: _____

Work duties: _____

Date of hire: _____ Duration of employment in years: _____

Symptoms related to bladder cancer:

1. Hematuria: _____ 2. Pain: _____ 3. Others: _____

Date of first symptom: _____ Date of diagnosis: _____

Diagnosis confirmed by histological specimen: 1. Yes: _____ 2. No: _____

Cell type of bladder cancer:

1. Transitional: _____ 2. Squamous: _____ 3. Adenocarcinoma: _____

Non-occupational risk factors:

1. Age: _____

2. Gender: 1. Male 2. Female

3. Family history of bladder cancer:
1. Yes 2. No 3. Not available

4. Smoking history:
1. Smoker 2. Non-Smoker 3. Previous Smoker 4. Not Known

Duration of smoking in years: _____ Date stopped smoking: _____

5. Recurrent renal stones: 1. Yes 2. No 3. Not available

6. Recurrent upper urinary tract infection:
1. Yes 2. No 3. Not available

7. History of analgesic abuse:
1. Yes 2. No 3. Not available

8. History of cyclophosphamide usage:
1. Yes 2. No 3. Not available

9. History of hair dye usage:
1. Yes 2. No 3. Not available

Occupational risk factors:

1. Naphthylamine (Alpha and Beta)
2. Benzidine
3. 4-Aminobiphenyl
4. Benzidine-based dyes
5. P-chloro-o-toluidine
6. 4,4-methylene-bis (2-chloroaniline)
7. Auramine
8. Ortho-toluidine
9. 4,4-methylene-bis (2-methylaniline)
10. Orthonitrotoluene
11. 3,3-dichlorobenzidine
12. 3,3-dimethoxybenzidine

Individual exposure assessment:

1. Biological monitoring 2. Hygiene data 3. Material safety data sheet 4. Work history 5. Others

Status of bladder cancer claim: 1. Allowed 2. Denied 3. Pending

If claim denied, was it appealed: 1. Yes 2. No

If yes, was the claim allowed: 1. Yes 2. No