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A retrospective study of hydatid cysts in patients undergoing liver and lung surgery in Tehran, Iran

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ABSTRACT

Hydatid cyst, caused by larval stages of *Echinococcus granulosus,* is a zoonotic parasitic disease with public health importance. The disease is cosmopolitan and endemic in Iran. We conducted a retrospective study of the records of Milad Hospital, Tehran, Iran to establish the proportion of lung and liver surgical procedures that were performed for removal of hydatid cyst and to investigate the demography of the population undergoing lung and liver hydatid cyst surgery in this hospital. A retrospective cross-sectional study was conducted of records of 682 patients who underwent liver (n = 404) or lung (n = 278) surgery from April 2009 to March 2013. In 404 liver surgeries, 111 (27.5%) diagnoses of hydatid cyst were verified. Liver hydatid infection demonstrated a significant age-related difference ($p < 0.05$). Cysts were found in 64 of 217 females (29.5%) and 47 of 187 males (25.1%). While in both sexes, more cysts were found in liver, the liver/lung ratio in females was significantly higher than in males ($p < 0.001$). Hydatid cyst was verified in 59 (21.2%) of 278 lung surgeries: 27 of 105 females (25.7%) and 32 of 173 males (18.5%). There was a significant relationship between sex and organ site ($p < 0.001$) with the proportion of hydatid cysts in males occurring in lung higher than seen in females. In the five investigated years, approximately 25% of liver and lung surgeries conducted at Milad Hospital were related to hydatidosis. Increasing public awareness of principles of avoiding infection could reduce the risk of nearly a quarter of liver and lung surgeries and costs associated with the treatment of hydatid cysts.

1. Introduction

Human infection with hydatid cyst occurs via consumption of food or water contaminated with *Echinococcus granulosus* eggs or by ingesting eggs picked up by direct contact with dogs infected with *E. granulosus*. Hydatidosis is an important parasitic disease in humans and domestic livestock of Iran (Kamali et al., 2018; Rokni, 2009) and is categorized as a neglected disease by the World Health Organization (Da Silva, 2010; Deplazes et al., 2017). It is cosmopolitan, especially in sheep breeding regions of Asia, Australia, South America, and Southern Europe (Deplazes et al., 2017; Mastrandrea et al., 2012). Hydatid cyst infection is endemic in Iran (Zeinali et al., 2017) and has been reported in all provinces (Shafiei et al., 2016) at a prevalence rate of 1% of surgeries (Rokni, 2009).

Diagnosis of hydatid cyst is primarily based on imaging and serological methods including direct hemagglutination, latex agglutination, immune-electrophoresis, and ELISA (Hernandez-Gonzalez et al., 2018), and surgery is the only reliable treatment for the disease in its final stages in humans. Pezeshki et al. (2007) studied prevalence of hydatid cyst for 2001–2004 in Milad Hospital, Tehran and reported 78 cases, 69.2% in liver and 11.5% in lung, in patients ranging from 14 to 76 years, with the highest occurrence (31.5%) in the 32–40 years age group.

We conducted a retrospective cross-sectional study of the lung and liver surgery records of Milad Hospital to determine the proportion of the surgical procedures that were performed for removal of hydatid cyst. A secondary goal was to analyze the data with respect to the demographic aspects of infected patients including, sex, age, surgery site, and place of residence.

2. Materials and methods

The retrospective cross-sectional study was conducted of 682 patients

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undergoing liver (n = 404) and lung (n = 278) surgery from April 2009 through March 2013. Three-hundred-sixty patients were male and 322 were female. Age ranged from ≤5 to ≥85 years (mean 46.8 ± 16.6). The mean age for liver surgery was 47.9 ± 17.1 (<9 to >85) years and for lung surgery was 45.1 ± 15.8 (<5 to >80) years (Table 1). The age range 26–35 years was most common in liver surgeries and 36–45 years in lung surgeries (Table 2).

Data were analyzed using SPSS software v. 20.0 (SPSS Inc., Chicago, IL, USA). Means and standard deviations are reported for age, sex, surgery site, and frequency of hydatid cyst in pathology reports. Chi-Square tests were used for evaluation of relationships between two qualitative variables. We used t-tests to investigate differences in mean age of males and females and between lung and liver patients. A p-value of <0.05 was considered significant.

3. Results

Of the 682 patients undergoing surgery, 170 (24.9%) were for removal of hydatid cyst, of whom 46.5% (79/170; 95% CI 39.1–54.0) were male and 53.5% (91/170; 95% CI 46.0–60.9) were female. Of 404 liver surgeries, 111 (27.5%; 95% CI 23.3–32.0) were for hydatid cyst removal. The proportion of males undergoing liver surgery that demonstrated hydatid cyst was 25.1% (47/187; 95% CI 19.5–31.8), and for females the proportion was 29.5% (64/217; 95% CI 23.8–35.9). Mean age of hydatidosis patients was 41.5 ± 16.5 years (Table 1). Liver hydatid cyst increased with age to its highest prevalence in the 26-35-year group and demonstrated a significant age-related difference ($p < 0.05$) with the lowest number of cases in the ≤15 and ≥76-year group (Table 2). Although both sexes showed higher levels of infection in liver than in lung, in females, that proportion was significantly greater than observed in males ($p < 0.001$). The average age of liver hydatid cyst patients was significantly lower than that of those with other liver diagnoses ($p < 0.001$).

Of 278 cases of lung surgery, 59 (21.2%; 95% CI 16.8–26.4) were to remove hydatid cysts, 32 of the 173 males (18.5%; 95% CI 13.4–24.9) and 27 of the 105 females (25.7%; 95% CI 18.3–34.8). Mean age was 39.2 ± 13.6 years (Table 1). The highest occurrence of lung hydatid cyst was seen in the age group 36–45 years, and the fewest in patients ≤15 and ≥76 years (Table 2). There was a significant relationship between sex and organ site ($p < 0.001$) with lung hydatid cyst more prevalent in males than in females.

Tehran Province contributed the highest number of patients undergoing surgery for liver and lung hydatid cyst with 61 and 31 cases, respectively, followed by nine and eight cases, respectively, from Alborz Province and one to three cases in each of the other represented provinces.

4. Discussion

Hospital records are a valuable resource for investigating the incidence of certain diseases (McManus et al., 2003). This study revealed that hydatid cyst was the reason for nearly a quarter of liver and lung surgeries during the study period. The proportion of liver surgeries conducted for hydatid cyst removal was higher than in lung surgeries, consistent with reported results in Iraq (Abdulhameed et al., 2018), China (Li et al., 2008), Turkey (Aribas et al., 2002), Italy (Agudelo Higuita et al., 2016), and Iran (Fallah et al., 2017; Islami Parkoohi et al., 2018; Pezeshki et al., 2007; Rokni, 2009). This seems likely due to the role of liver as central to the system that provides initial filtering of ingested ova from the blood (McManus et al., 2003).

We found the highest occurrence of liver and lung hydatid cyst surgery in patients 26–45 years, similar to observations in New Zealand (Burridge et al., 1977). The highest rate of hydatid cyst was reported to be in the age range of 44–54 and 70–79 years in Tasmania (Thompson and McManus, 2002) and Uruguay (Perdomo et al., 1997). In Yemen, the highest incidence was seen in individuals younger than 20 years old, and the age range of 41–60 years showed the lowest (Al-Shaibani et al., 2015). As hydatid cyst growth is generally one to five centimeters/year or may persist unchanged for years (McManus et al., 2003; Siracusano et al., 2009), duration of infection is likely the principle reason for these differences.

An association of sex and organ site ($p < 0.001$) was observed in our study, with males exhibiting lung/liver cysts showing a higher proportion of lung infection than did females, similar to previous reports from Iran (Kamali et al., 2018) and Italy (Cappello et al., 2013). In females, we found a significantly higher fraction of the hydatid cysts to occur in the liver compared to that proportion in the males ($p < 0.001$). These findings are similar to those reported in Iran (Fati and Nawazi, 1992; Kakhi and Rouhani, 1994; Nourjah et al., 2004) and other areas including Jordan (Amr et al., 1994; Kamhawi, 1995), Austria (Schneider et al., 2010), Sudan (Omer et al., 2010), and Yemen (Al-Hureibi et al., 1992). Overall, hydatid cyst is more prevalent in females compared to males. The differences could be the result of the lifestyle of women, who may be more likely to be in direct contact with a source of infection, such as vegetables and soil contaminated with eggs of *E. granulosus* (Rao et al., 2012).

The study was conducted in patients referred to a single center, which might limit generalization of results to all patients undergoing liver and lung surgery in Iran, although Milad Hospital is a referral center and receives patients from all areas of the country. In addition, limited access

Table 2
Age of patients undergoing liver and lung surgery for hydatid cyst removal 2009–2013.

Age years	Liver surgery No. (%)	Liver hydatid cyst No. (%)	Lung surgery No. (%)	Lung hydatid cyst No. (%)
≤15	3 (0.7)	2 (1.8)	3 (1.1)	0 (0.0)
16–25	33 (8.2)	13 (11.7)	29 (10.4)	10 (16.9)
26–35	70 (17.3)	31 (27.9)	37 (13.3)	11 (18.6)
36–45	45 (11.1)	16 (14.4)	50 (18.0)	12 (20.3)
46–55	69 (17.1)	12 (10.8)	54 (19.4)	8 (13.6)
56–65	71 (17.6)	21 (18.9)	39 (14.0)	5 (8.5)
66–75	48 (11.9)	5 (4.5)	22 (7.9)	2 (3.4)
≥76	14 (3.5)	2 (1.8)	4 (1.4)	0 (0.0)
Unknown	51 (12.6)	9 (8.1)	40 (14.4)	11 (18.6)
Total	404 (100)	111 (100)	278 (100)	59 (100)

Table 1
Demographic characteristics of patients undergoing liver and lung surgery 2009–2013.

Surgery site	Liver				Lung			
Diagnosis	Hydatid cyst		p	Total	Hydatid cyst		p	Total
	Yes	No			Yes	No		
	111	293		404[a]	59	219		278
Male	47	140		187	32	141		173
Female	64	153	0.372	217	27	78	0.174	105
Mean age	41.5 ± 16.5	50.5 ± 16.7	<0.001	47.9 ± 17.1[b]	39.2 ± 13.7	46.6 ± 16.0	0.003	45.1 ± 15.8

[a] significant relationship between sex and surgery site ($p < 0.001$).
[b] significant difference in age of patients based on surgery site ($p = 0.04$).

to information precluded categorizing the diagnoses and background of the patients as well as surgical management. Further studies in a multi-referral center with increased access to patient documents could provide more information and expand on the findings of this investigation.

5. Conclusion

Over the five-year study period, nearly 25% of liver and lung surgeries in Milad Hospital were related to hydatidosis. A health education program to increase awareness of how hydatidosis is transmitted, along with regular anthelminthic treatment of dogs, would help to reduce infection rates and the need for surgical intervention with its attendant costs and associated risk.

Declarations

Author contribution statement

Elham Razmjou: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Maryam Moradi: Performed the experiments; Analyzed and interpreted the data; Contributed analysis tools or data; Wrote the paper.

Zahra Rampisheh: Analyzed and interpreted the data; Contributed analysis tools or data.

Mona Roozbehani: Contributed analysis tools or data.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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