A study of the outcome of confirmed avian flu and swine flu cases admitted to Abbassia Chest Hospital between 2006 and 2010

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Background Type A viruses are the most virulent human pathogens among the three influenza types and cause the most severe disease: H1N1, which caused swine flu in 2009, and H5N1, which caused avian flu in 2004.

Aim The aim of this study was to evaluate the clinical and epidemiological features and the treatment outcome of confirmed cases of avian flu and swine flu admitted in Abbassia Chest Hospital between 2006 and 2010.

Patients and methods This was a retrospective study that included 213 patients PCR-positive for influenza A H1N1 and 23 patients PCR-positive for influenza A H5N1, who were admitted to Abbassia Chest Hospital during the period from March 2006 to December 2010. The following data were collected by retrospective reviews of hospital records for each patient: epidemiological data through interview with the patient or their relatives, full history data, complete clinical examination data, full laboratory investigations, chest radiograph film at the time of admission and during the hospitalization period, a nasopharyngeal swab, ECG, and arterial blood gases. Statistical analysis of the data was then carried out.

Results Regarding swine flu cases, there was no statistical difference with regard to the age distribution, the sex distribution, the presence of comorbidities, and the time of presentation among the studied patients. The results showed that 170 patients recovered, whereas 43 died, with a mortality rate of 20.2%. Among the avian flu cases, seven patients recovered, whereas 16 died, with a mortality rate of 69.5%. The mortality rate was high in renal patients, patients having bilateral complicating pneumonia, and in the patients who needed mechanical ventilation.

Conclusion Some comorbidities, such as diabetes mellitus, cardiac illness, and chronic chest illness, have no implication on mortality. In contrast, renal conditions and the need of mechanical ventilation were associated with a high mortality rate. *Egypt J Broncho* 2014 8:70–78
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Introduction

Influenza is a serious respiratory illness that can be debilitating and cause complications that lead to hospitalization and death, especially in the elderly. Every year, the global burden of influenza epidemics is believed to be 3–5 million cases of severe illness and 300 000–500 000 deaths. The risk of serious illness and death is highest among persons older than 65 years, children younger than 2 years, and among individuals who have medical conditions that place them at increased risk of developing complications from influenza [1].

Influenza type A viruses have conserved their actuality and importance over time with respect to genetic variations and global pandemics. In recent years, their significance has increased because of the appearance of 'bird flu' caused by a highly virulent strain of the H5N1 subtype. Although influenza type A viruses that cause infections in birds (avian influenza) are species specific, some may cross the species barrier to infect humans. Previously, it was believed that direct transmission of virus from birds to humans could not take place, but it came to be true in 1997 in Hong Kong. As avian influenza virus A (H5N1) causes human infections with high morbidity and mortality rates, the probability of human-to-human transmission and its consequences attract a great deal of attention [2].

In March 2009, a novel strain of swine-origin influenza-A H1N1 caused human infection in Mexico, and spread to all regions in the world in the following 3 months. In 11 June 2009, the WHO declared that a global pandemic of influenza A H1N1 was underway. This action was a reflection of the spread of the new H1N1 virus, and not of the severity of illness caused by the virus. As of October 2009, there were about 400 000 confirmed cases and 5000 mortalities due to pandemic H1N1 all over the world. The most important step against pandemic H1N1 is prevention, which means, first of all, the adherence to hygienic rules and the use of vaccination [3].

With 149 confirmed cases until May 2011, the largest number of cases outside Southeast Asia, Egypt now

ranks second among all countries reporting human infections with H5N1, after Indonesia. In 2011, Egypt has reported the maximum number of human cases of avian influenza A (H5N1) in the globe (30 cases out of total 45 cases reported until 16 June 2011). Of the 30 cases reported from Egypt in 2011, a total of 11 cases were fatal (case fatality rate: 36.7%). Egypt also reported the highest number of cases in the globe in 2010 (29 cases), followed by Indonesia ($n = 9$), Vietnam ($n = 7$), China ($n = 2$), and Cambodia ($n = 4$).

The first case of novel flu A/H1N1 discovered by the Ministry of Health was on 1 June 2009 in a 13-year-old girl coming from USA. The statistics of the preventive sector in the Ministry of Health showed that the number of lab-confirmed cases of novel flu A/H1N1 was 16 373. The incidence of the infection was 53.3% among male patients and 46.7% among female patients, with an average age of 21 years and a mean of 17 years. The youngest patient was 15 days old and the oldest was 90 years old. The highest infection rate was in the age group of 5–24 years (53.6%), followed by the age group of 25–65 years (33.7%), and the lowest affected age group was 65+ years (1.4%). The patient in the first case died in July 2009; the total number of deaths was 281. Most of the deaths happened during December 2009 (115 cases), 79% of which were cases with underlying chronic diseases (comorbidities) or pregnant women. Most of the deaths were in the age group of 20–30 years; 76% were at urban governorates (Cairo, Giza, and Alexandria), whereas 24% were at rural governorates [5].

Aim

The aim of this study was to evaluate the clinical and epidemiological features and the treatment outcome of confirmed cases of avian flu and swine flu admitted to Abbassia Chest Hospital between 2006 and 2010.

Patients and methods

This study was a retrospective study that included 213 patients PCR-positive for influenza A H1N1 and 23 patients PCR-positive for influenza A H5N1, who were admitted to Abbassia Chest Hospital during the period from March 2006 to December 2010.

All patients were subjected to the following:

(1) Full history taking.
(2) Thorough clinical examination.
(3) Full laboratory investigations.
(4) Nasopharyngeal swab, sputum, or bronchial lavageculture and sensitivity.
(5) Chest radiology.

(6) ECG.
(7) Echocardiography.
(8) Arterial blood gases.

All data were collected for statistical analysis to find out any possible relationship between the outcome of the disease and the following variables:

(1) Age.
(2) Sex.
(3) Comorbidities [e.g. diabetes mellitus (DM), ischemic heart disease, congestive heart failure, any chronic chest disease such as chronic obstructive pulmonary disease, bronchial asthma or interstitial lung fibrosis, end-stage renal failure, and chronic liver diseases].
(4) Need for invasive or noninvasive mechanical ventilation and its duration.
(5) The duration between the start of symptoms and presentation to the hospital.
(6) Complication by bacterial pneumonia.

Data management and analysis

Data collected were revised, coded and tabulated using the statistical package for the social sciences (SPSS 15.0.1, 2001; SPSS Inc., Chicago, Illinois, USA) for Windows. Data were presented and suitable analysis was carried out according to the type of data obtained for each parameter.

(1) Descriptive statistics:
  (a) Mean.
  (b) ±SD.
  (c) Minimum and maximum values (range) for numerical data.
  (d) Frequency and percentage of non-numerical data.
(2) Analytical statistics:
  (a) The χ^2-test was used to compare two qualitative variables.
  (b) The independent samples t-test was used to assess the statistical significance of the difference between two study group means.

P value was used to determine the level of significance. P value more than 0.05 was considered nonsignificant, P value less than 0.05 was considered significant, and P value less than 0.01 was considered highly significant.

Results
Swine flu cases

In this study, there were 213 PCR-confirmed swine flu cases. This study included 96 (45%) male and 117 (55%) female patients. In total, 170 (79.8%) patients bypassed their illness, whereas 43 (20.2%) died, with no statistical difference with regard to the relation between sex distribution and mortality among the studied patients,

as shown in Table 1. Forty-one (19.2%) patients were less than 10 years old, 10 (4.7%) patients were more than 61 years old, whereas 161 (75.6%) patients were in the age group of 11–60 years, with no statistical difference with regard to the relation between age distribution and the mortality among the studied patients, as shown in Fig. 1. Causes of death were septicemia in 25 (58.1%) cases and respiratory failure with acute respiratory distress syndrome in 18 (41.9%) cases.
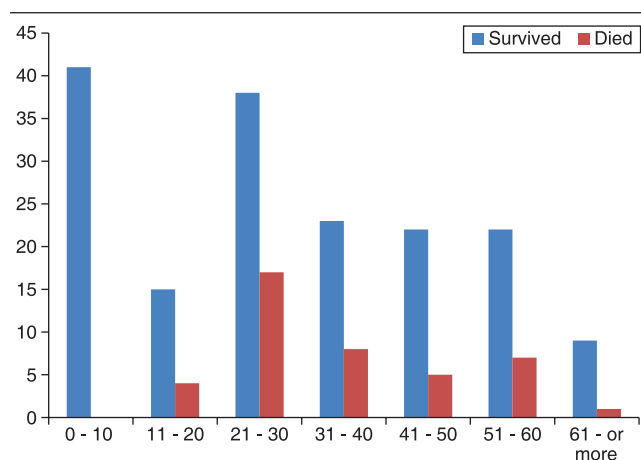
Percentages of mortality in each age group were as follows: 4/19 (21.1%) patients in the 11–20-year age group, 17/55 (30.9%) patients in the 21–30-year age group, 8/31 (25.8%) patients in the 31–40-year age group, 5/27 (18.5%) patients in the 41–50-year age group, 7/29 (24.1%) patients in the 51–60-year age group, and 1/10 (10%) patients in the over 61-year age group.

Relation between risk factors and mortality showed that there was a significant statistical difference in the mortality of cases with end-stage renal failure (100%), whereas there was no statistical difference in the mortality of all other risk factors including hepatic patients (40%), pregnant patients (35.3%), and cardiac patients (31.8), as shown in Table 2.

Prominent clinical symptoms in the swine flu group on admission were dry cough (205/213, 96%), followed by fever (177/213, 83%), dyspnea (154/213, 72%), productive cough (117/213, 54%), chest pain and vomiting (24/213, each 11%), hemoptysis (18/213, 8%), and diarrhea (10/213, 4%), as shown in Fig. 2.

There was no significant statistical difference with regard to the relation between the presenting time (days) and mortality, although the highest mortality was in the range of 5–6 days (29%), followed by 9–10 days (27.3%) and 7–8 days (26.2%), whereas the least

Table 1 Relation between sex and mortality in swine flu cases

Sex	n (%)		
	Survived	Died	Total
Male	77 (80.2)	19 (19.8)	96 (100)
Female	93 (79.5)	24 (20.5)	117 (100)
Total	170 (79.8)	43 (20.2)	213 (100)
$t = 0.017$	$P = 0.896$ (NS)		

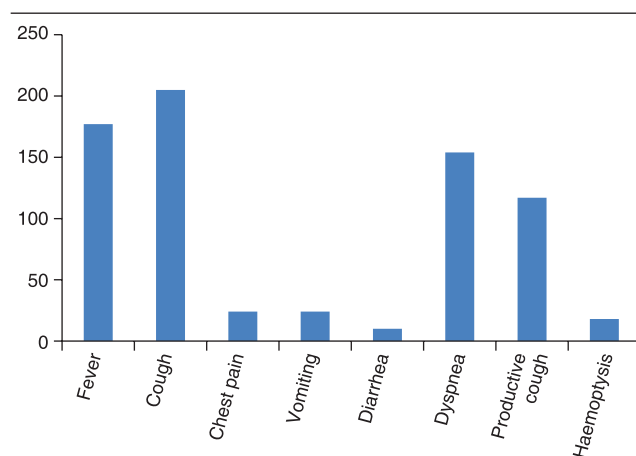**Table 2 Relation between risk factors and mortality in the swine flu group**

Risk factors	n (%)			
	Survived	Died	Total	Statistical difference
DM	18 (72)	7 (28)	25 (100)	$t = 1.073$ $P = 0.300$NS
Pregnancy	11 (64.71)	6 (35.3)	17 (100)	$t = 7.504$ $P = 0.483$NS
Chronic chest diseases	63 (96.9)	2 (3.1)	65 (100)	$t = 19.533$ $P = 0.1$NS
Hepatic diseases	3 (60)	2 (40)	5 (100)	$t = 1.247$ $P = 0.264$NS
Renal diseases	0	2 (100)	2 (100)	$t = 7.982$ $P = 0.005$HS
Cardiac diseases	15 (68.2)	7 (31.8)	22 (100)	$t = 1.126$ $P = 0.289$NS
Smoking	35 (72.9)	13 (27.1)	48 (100)	$t = 1.244$ $P = 0.265$NS

DM, diabetes mellitus; HS, highly significant.

Table 3 Relationship between the duration of illness before hospitalization and mortality

Duration of illness (days)	n (%)		
	Survived	Died	Total
1–2	34 (85)	6 (15)	40 (100)
3–4	53 (91.4)	5 (8.6)	58 (100)
5–6	22 (71)	9 (29)	31 (100)
7–8	31 (73.81)	11 (26.2)	42 (100)
9–10	15 (68.2)	7 (31.8)	22 (100)
>10	15 (75)	5 (25)	20 (100)
Total	170 (79.8)	43 (20.2)	213 (100)
$t = 8.898$	$P = 0.113$ (NS)		

Fig. 1

Age distribution among the patients who survived and died in the swine flu group.

Fig. 2

Symptoms at hospitalization in the swine flu group.

mortality was at 3–4 days (8.6%) and 1–2 days (15%); this means that the earlier the hospitalization, the lesser the mortality, as shown in Table 3.

There was a highly statistical difference in routine investigations such as potassium, sodium, magnesium, renal functions (urea/creatinine), liver functions (glutamic oxaloacetic transaminase/glutamic pyruvic transaminase), total protein, albumin, and hemoglobin, whereas there was no statistical difference in the total leukocyte count with regard to mortality, as shown in Table 4.

There was a highly statistical difference with regard to complicating pneumonia in relation to mortality, as shown in Table 5.

There was a highly statistical difference with regard to the need for mechanical ventilation and mortality, as shown in Table 6.

Avian flu cases
In this study, there were 23 PCR-confirmed avian flu cases. This study included four (17.4%) male and 19 (82.6%) female patients, as shown in Table 7. Of them, 14 (60.8%) patients were less than 30 years old, whereas nine (39.2%) were in the age group of 30–60 years, as shown in Table 8.

Table 9 shows that patients with DM, pregnant women, patients with cardiac illness, and smoking patients have the highest mortality.

Also, Fig. 3 shows that fever and cough were the most common presenting symptoms, occurring in 18/23 (78.3%) cases each, followed by dyspnea [12/23 (52.2%)], productive cough [10/23 (43.5%)], vomiting [5/23 (21.8%)], diarrhea [3/23 (13%)], and hemoptysis [2/23 (8.7%)].

Table 10 revealed that the most common duration of illness before hospitalization was between 4 and 7 days in 11 (47.8%) cases, followed by a duration of more than 8 days in 10 (43.5%) cases.

The highest mortality was recorded in cases with impaired renal functions, leukocytosis, hypoproteinemia, and hypoalbuminemia (100%), followed by cases with high liver enzymes (glutamic oxaloacetic transaminase, glutamic pyruvic transaminase) (90.9%), followed by cases with electrolyte disturbances: sodium (69.6%), potassium (62.3%), and calcium (50.0%), as shown in Table 11.

Table 12 shows that bilateral pneumonia was associated with the highest mortality of 14/16 (87.5%), followed by unilateral pneumonia 2/5 (40%), whereas there were no recorded mortality cases in patients without

Table 4 Relation between the results of routine investigations and mortality in the swine flu group

Investigations		*n* (%)			Statistical difference
	Values	Survived	Died	Total	
K	Normal	168 (84.4)	31 (15.6)	199 (100)	*t* = 40.793
	Increased	1 (33.3)	2 (66.7)	3 (100)	*P* = 0.001 (HS)
	Decreased	1 (9.1)	10 (90.9)	11 (100)	
Na	Normal	171 (80.2)	41 (19.8)	212 (100)	*t* = 3.972
	Decreased	0	1 (100)	1 (100)	*P* = 0.046 (S)
Mg	Normal	166 (85.6)	28 (14.4)	194 (100)	*t* = 44.702
	Decreased	4 (21.1)	15 (78.9)	19 (100)	*P* = 0.001 (HS)
Urea	Normal	163 (82.3)	35 (17.7)	198 (100)	*t* = 11.003
	Increased	7 (46.81)	8 (53.3)	15 (100)	*P* = 0.001 (HS)
Creatinine	Normal	163 (82.3)	34 (17.3)	197 (100)	*t* = 3.963
	Increased	7 (46.81)	9 (56.3)	16 (100)	*P* = 0.001 (HS)
TLC	Normal	139 (80.8)	33 (19.2)	172 (100)	*t* = 2.256
	Increased	22 (71)	9 (29)	31 (100)	*P* = 0.324 (NS)
	Decreased	9 (90)	1 (10)	10 (100)	
Hb	Normal	166 (81.8)	37 (18.2)	203 (100)	*t* = 12.213
	Increased	2 (66.7)	1 (33.3)	3 (100)	*P* = 0.002 (HS)
	Decreased	2 (28.6)	5 (71.4)	7 (100)	
SGOT	Normal	146 (88)	20 (12.2)	166 (100)	*t* = 30.934
	Increased	24 (51.1)	23 (46.9)	47 (100)	*P* = 0.001 (HS)
SGPT	Normal	144 (87.8)	20 (12.2)	164 (100)	*t* = 28.265
	Increased	2 (53.1)	23 (46.9)	49 (100)	*P* = 0.001 (HS)
Albumin	Normal	169 (84.5)	31 (15.5)	200 (100)	*t* = 44.694
	Decreased	1 (7.7)	12 (92.3)	13 (100)	*P* = 0.001 (HS)
Total protein	Normal	169 (84.5)	31 (15.5)	200 (100)	*t* = 44.694
	Decreased	1 (7.7)	12 (92.3)	13 (100)	*P* = 0.001 (HS)

Hb, hemoglobin; HS, highly significant; S, significant; SGOT, serum glutamic oxaloacetic transaminase; SGPT, serum glutamic pyruvic transaminase; TLC, total leukocyte count.

Table 5 Relation between the severity of complicating pneumonia and mortality in the swine flu group

Pneumonia	n (%)		
	Survived	Died	Total
No pneumonia	89 (97.8)	2 (2.2)	91 (100)
Unilateral	55 (90.2)	6 (9.8)	61 (100)
Bilateral	27 (44.3)	34 (55.7)	61 (100)
$t = 98.991$	$P = 0.001$ (HS)		

HS, highly significant.

Table 6 Relation between the need for mechanical ventilation and mortality

Need for ventilation	Number of patients	Died	Survived
MV (invasive)	40 (18.8)	38 (95)	2 (5)
No MV	173 (81.2)	5 (2.9)	168 (97.1)
$t = 75.214$	$P = 0.001$ (HS)		

MV, mechanical ventilation.

Table 7 Sex distribution among the patients studied in the avian flu group

Sex	Number (%)
Male	4 (17.4)
Female	19 (82.6)
Total	23 (100)

Table 8 Age distribution among the patients studied in the avian flu group

Age	Number (%)
11–20	5 (21.7)
21–30	9 (39.1)
31–40	7 (30.4)
41–50	1 (4.3)
51–60	1 (4.3)
Total	23 (100)

Table 9 Relation between comorbidity and mortality in the avian flu group

Comorbidities	n (%)		
	Survived	Died	Total
DM	0 (0)	2 (100)	2 (100)
Pregnancy	0 (0)	1 (100)	1 (100)
Chronic chest diseases	1 (50)	1 (50)	2 (100)
Cardiac diseases	0 (0)	1 (100)	1 (100)
Smoking	0 (0)	3 (100)	3 (100)

DM, diabetes mellitus.

Table 10 Duration of illness before hospitalization in the avian flu group

Durations of illness (days)	Number of cases (%)
1–3	2 (8.7)
4–7	11 (47.8)
>8	10 (43.5)

pneumonia.

Table 13 shows that there was a highly statistical difference with regard to the need for mechanical

Table 11 Relationship between results of the investigation and mortality in the avian flu group

Investigations	n (%)			
	Values	Survived	Died	Total
K	Normal	4 (26.7)	11 (73.3)	199 (100)
	Decreased	3 (37.5)	5 (62.5)	3 (100)
Na	Norma	7 (30.4)	16 (69.6)	23 (100)
Mg	Normal	6 (27.3)	16 (72.7)	194 (100)
	Decreased	1 (100)	0 (0)	1 (100)
Ca	Normal	5 (26.3)	14 (73.7)	19 (100)
	Decreased	2 (50)	2 (50)	4 (100)
Urea	Normal	7 (50)	9 (56.3)	16 (100)
	Increased	0 (0)	7 (100)	7 (100)
Creatinine	Normal	7 (50)	7 (50)	14 (100)
	Increased	0 (0)	9 (100)	9 (100)
TLC	Normal	6 (66.7)	3 (33.3)	9 (100)
	Increased	0 (0)	5 (100)	5 (100)
	Decreased	1 (11.1)	8 (88.9)	9 (100)
Hb	Normal	7 (31.8)	15 (68.2)	22 (100)
	Decreased	0 (0)	1 (100)	1 (100)
SGOT	Normal	6 (50)	6 (50)	12 (100)
	Increased	1 (9.1)	10 (90.9)	11 (100)
SGPT	Normal	6 (50)	6 (50)	12 (100)
	Increased	1 (9.1)	10 (90.9)	11 (100)
Albumin	Normal	7 (36.8)	12 (63.2)	19 (100)
	Decreased	0 (0)	11 (100)	11 (100)
Total protein	Normal	7 (36.8)	12 (63.2)	19 (100)
	Decreased	0 (0)	4 (100)	4 (100)

Hb, hemoglobin; SGOT, serum glutamic oxaloacetic transaminase; SGPT, serum glutamic pyruvic transaminase; TLC, total leukocyte count.

Table 12 Relation between the presence and the extent of pneumonia and mortality in the avian flu group

Radiological findings	n (%)	
	Cases	Mortality
No pneumonia	2 (8.7)	0 (0)
Unilateral	5 (21.7)	2 (40)
Bilateral	16 (69.6)	14 (87)

Table 13 Relation between the need for mechanical ventilation and mortality in the avian flu group

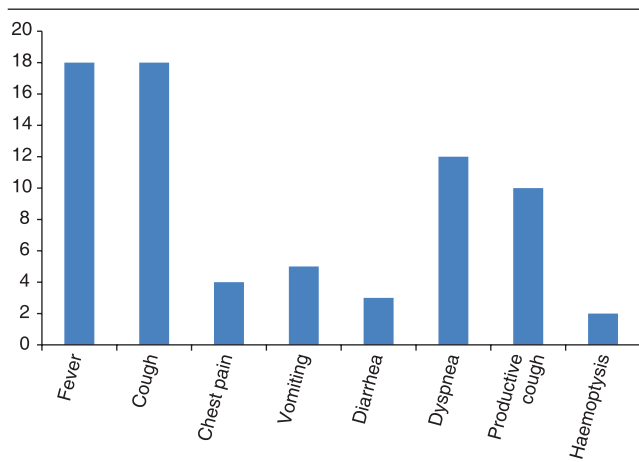| Need for ventilation	n (%)		
	Patients	Died	Survived
MV (invasive)	16 (69.6)	16 (100)	0 (0)
No MV	7 (30.4)	0 (0)	7 (100)

MV, mechanical ventilation.

ventilation and mortality. Causes of death were septicemia in nine (56.2%) cases and respiratory failure with acute respiratory distress syndrome in seven (43.8%) cases.

Discussion
Swine flu
In the present study, we found that 170 (79.8%) patients recovered, whereas 43 (20.2%) patients died. This result agrees with that of Kumar et al. [6], who studied the

Fig. 3

Symptoms in the patients studied in the avian flu group.

outcome of critically ill patients with 2009 influenza A (H1N1) in Canada: the study included 168 patients and the mortality rate was 17.3%. It also agrees with the results of Rello *et al.* [7], who studied the outcome of critically ill patients with 2009 influenza A (H1N1) in Spain: the study included 32 patients and the mortality rate was 18.75%.

These results disagree with that of Domínguez-Cherit *et al.* [8], who discussed the outcome of critically ill patients with 2009 influenza A (H1N1) in Mexico: the study included 58 patients and the mortality rate was 41.3%. The difference may be due to the smaller number of patients included in that study.

Regarding the relation between age and the final outcome, we found that the number of patients below or equal to 40 years of age was 146 (68.5%): 117 (80.1%) of them recovered, whereas 29 (19.9%) of them died. The number of patients above 40 years of age was 67 (31.5%): 53 (79.1%) of them recovered, whereas 14 (20.9%) of them died, with no statistical relation between the age and the final outcome. This agrees with Duarte *et al.* [10] who studied 63 critically ill patients in Brazil, with their age ranging from 13 to 65 years, and a mean of 35 years: 70% were below 40 years old and 30% were above 40 years old; 84% of the patients below 40 years recovered and 16% of the patients below 40 years died, with no age-related difference in mortality. In contrast, this result disagrees with that of Rello *et al.* [7], who studied 32 critically ill patients in Spain, with their age ranging from 31 to 52 years and a mean of 40±13.9 years. The mortality was more common in young adults, and this difference may be because the age of the patients included in that study ranged from 31 to 52 years and also due to the smaller number of patients in this study.

Regarding the relation between sex and the final outcome, we found that the total number of males patients was 96, 77 (80.2%) of them recovered, whereas 19 (19.8%) died, and the total number of females patients was 117, 93 (79.5%) of them recovered, whereas 24 (20.5%) died, with no statistical relation between the sex and the final outcome.

This agrees with Domínguez-Cherit *et al.* [8], who studied 58 critically ill patients in Mexico: 53.4% of them were female and 46.6% were male. The number of recovered patients was 33: 56% female and 44% male. The number of patients who died was 25, 50% were female and 50% were male, with no sex-related difference in mortality. This result also agrees with Kumar *et al.* [6] who studied 168 critically ill patients in Canada: 67.3% of them were female and 32.7% of them were male. The number of recovered patients was 139: 66% of them were female and 34% were male. The number of patients who died was 29: 72% of them were female and 28% were male, with no sex-related difference in the mortality. In contrast, this result disagrees with that of Rello *et al.* [7], who studied 32 critically ill patients in Spain: 73.3% of them were male and 26.7% of them were female. The mortality rate was higher in male patients due to their higher number in that study.

Regarding the relation between the presence of comorbidity and the final outcome, we found that the total number of patients with comorbidity was 133 (62.4%): 108 (81.2%) recovered, whereas 25 (18.8%) died. There were 25 diabetic patients: 72% recovered and 28% died. There were 21 cardiac patients: 71.4% recovered and 28.6% died. There were 63 chronic chest patients: 96.8% recovered and 3.2% died. In contrast, there were two renal patients and all of them died. There were five hepatic patients: 60% recovered and 40% died. Finally, there were 17 pregnant women: 64.7% recovered and 35.3% died.

This means that there was no statistical relation between the presence of DM, cardiac illness, chronic chest illness, or pregnancy and mortality, whereas the mortality rate was high in renal patients and hepatic patients.

This result agrees with that of Rello *et al.* [7], who studied 32 critically ill patients in Spain: 53.1% of them were comorbid and 46.9% were not; 3.1% were diabetic, 3.1% had cardiac disease, 18.75% had chronic chest disease, 3.1% had neural disease, 3.1% had renal disease, and 6.2% were pregnant. This result agrees with that of Kumar *et al.* [6], who studied 168 critically ill patients in Canada: 35% of them were comorbid and 65% were not; 20.8% were diabetic, 14.9% were cardiac

patients, 41.1% had chronic chest disease, 15.5% had neural disease, 7.1% had renal disease, and 7.7% were pregnant. The number of recovered patients was 139, and 23% of them were co morbid. The total number of deaths was 29: 21% of them were comorbid, with no comorbidity-related difference in mortality, but it is different in renal and hepatic patients due to their small number in our study.

Regarding the relation between the time of presentation and the final outcome, we found that 128 (60.1%) patients presented to the hospital before 7 days of the beginning of symptoms: 108 (84.3%) of them recovered, whereas 20 (15.7%) of them died; 85 (39.9%) patients presented to the hospital after 7 days of the beginning of symptoms: 63 (74.1%) of them recovered, whereas 22 (25.9%) of them died, with no statistical difference with regard to the time of presentation to the hospital and the final outcome. This result agrees with Domínguez-Cherit et al. [8] who studied 58 critically ill patients in Mexico: their time of presentation ranged from 4 to 8 days, with a mean of 7 days. These results also agree with that of Asmaa et al. [9], who studied 80 critically ill patients who were admitted at the ICU of Abbassia Chest Hospital: 43 (53.7%) of them presented before 7 days of the beginning of symptoms, whereas 37 (46.3%) presented after 7 days.

Regarding the relation between the severity of complicating pneumonia and the final outcome, we found that 61 (28.6%) patients had unilateral pneumonia: 90.2% of them recovered and 9.8% of them died; 61 (28.6%) patients had bilateral pneumonia: 27 (44.3%) of them recovered, whereas 34 (55.7%) of them died, with a highly significant statistical relation between the severity of complicating pneumonia and mortality. This agrees with Rello et al. [7] who studied 32 critically ill patients in Spain: nine (28.1%) patients had unilateral pneumonia and 23 (71.9%) had bilateral pneumonia. The total number of deaths was six, and all of them had bilateral pneumonia, whereas the number of recovered patients was 26, nine of them had unilateral pneumonia (i.e. all of the unilateral pneumonic patients were cured), with a statistical relation between the severity of complicating pneumonia (bilateral) and mortality. This also agrees with Asmaa et al. [9] who studied 80 critically ill patients who were admitted to the ICU of Abbassia Chest Hospital. Among them, 21 (26.3%) patients had unilateral pneumonia: 80.9% recovered, whereas 19.1% died; 59 (73.8%) patients had bilateral pneumonia: 37.3% recovered, whereas 62.7% died.

Regarding the relation between mechanical ventilation and the final outcome, we found that 40 patients were mechanically ventilated: two (5%) of them recovered, whereas 95% of them died, with a highly significant statistical relation between mechanical ventilation and mortality. This agrees with the study of Rello et al. [7] who studied 32 critically ill patients in Spain: eight (25%) of them were not ventilated, whereas 24 (75%) were ventilated. The number of recovered patients was 26: 78.5% of them were mechanically ventilated, and 21.5% of them were not. The number of deaths was six: 100% of them were mechanically ventilated, with mechanical ventilation-related mortality.

In contrast, this result disagrees with Duarte et al. [10] who studied 63 critically ill patients in Brazil: 71.4% of them were mechanically ventilated, whereas 28.6% were not. The number of recovered patients was 38: 20 (52.6%) patients were mechanically ventilated and 18 (47.4%) were not. The number of deaths was 25: 14 (53%) patients were mechanically ventilated, whereas 11 (47%) were not, with no mechanical ventilation-related difference in mortality. The difference between the two studies may be due to the fact that 26 out of the 63 patients in the study of Duarte et al. [10] were RT-PCR negative.

Avian cases
In the present study, there was a female predominance [82.6% (19/23)] as compared with male [17.4% (4/23)], and this agrees with the study conducted by United States Naval Medical Research Unit No. 3 (US NAMRU-3) [11] on 63 avian influenza (AI) confirmed case in Egypt: 23 of them were male and 40 were female (sex ratio = 0.6).

Female predominance was also reported by Fasina et al. [12] in their study on 85 AI confirmed cases in Egypt, as they found that 62.3% (53/85) of the cases were female and 37.5% (32/85) were male patients.

In the current study, the mean age of the patients who survived was 30.75 years, and the mean age of the patients who died was 28.9 years (range 11–60 years): 91.2% of cases occurred among individuals under the age of 40 years.

Dudley et al. [13] in their study noted that the age group of 20–39 years was the predominantly affected group, which is in agreement with the results of this study. In addition, similar results were reported by Giriputro et al. [14] in their study on 27 AI confirmed case in Indonesia, they reported that AI in humans was predominately a disease of young age and adolescence, as the mean age was 16 years, and the oldest patient was 40 years old.

In the current study, fever and cough were the main complaints, 78.2% (18/23) each, followed

by dyspnea [69.5% (16/23)], productive cough [43.4 (10/23)], vomiting [21.7% (5/23)], chest pain [17.3% (4/23)], diarrhea [13% (3/23)], and hemoptysis [8.7% (2/23)].

Tran *et al.* [15] in their study reported that the prominent clinical features on admission were those of severe influenza syndrome with fever, cough, diarrhea present in 70% (7/10) of the patients, which is in agreement of the results of this study. This result is also in agreement with Waleed *et al.* [16], who in his study reported that fever was the main complaint occurring in 93.3% (14/15) of the cases, followed by muscle/joint pain [53.3% (8/15)], sore throat and dry cough [40% (6/15) each], shortness of breath [33.3% (5/15)], productive cough and vomiting [26.7% (4/15) each], diarrhea and headache [20% (3/15) each], and abdominal pain and sneezing were the least occurring symptoms, with 6.7% (1/15) each.

In the present study, 91.5% of the patients presented without pneumonia, 69.6% had bilateral pneumonia (16/32), 21.7% had unilateral pneumonia, whereas 8.7% had normal chest radiograph (2/23). In the present study, 91.3% of patients presented with pneumonia, 69.6% had bilateral pneumonia(16/23), 21.7% had unilateral pneumonia (5/23) while 8.7% had normal chest x-ray (2/23). This study agrees with Waleed *et al.*, (2010) [16] as he reported that 86.7% of patients presented with abnormal plain chest x-ray, {60% of them (9/15) had bilateral chest infiltrates, 26.7% (4/15) had unilateral chest infiltrates}, while only 13.3% (2/15) had normal plain chest x-ray.

In the present study, 47.8% of the patients had elevated liver enzymes (serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase) with a mortality of 90.1%, followed by leukopenia and elevated creatinine (39.1% each) with a mortality of 88.9 and 100%, respectively, hypokalemia with a mortality of 62.5%, elevated urea with a mortality of 100%, followed by leukocytosis (21.7%) with a mortality of 100%, hypocalcemia, hypoproteinemia, and hypoalbuminemia (17.4%) with a mortality of 50, 100, and 100%, respectively, followed by hypomagnesemia and anemia (4.3%) with a mortality of 0 and 100%, respectively. Waleed *et al.* [16] reported in their study that 73.3% of the patients had elevated aspartate aminotransferase (53.3%) and elevated alanine aminotransferase. Chotpitayasunondh *et al.* [17] reported in their study that 58% of the patients had leukopenia and 33% of the patients had elevated serum creatinine (>1.5 mg/dl).

In this study, 16/23 (69.6%) patients were mechanically ventilated, with a morbidity of 100%, which agrees with the study of Kandun *et al.* [18], who studied eight critically ill patients in Indonesia: four (50%) required mechanical ventilation, with a mortality of 100%; it also agrees with the study of Waleed *et al.* [16], who had 14/15 mechanically ventilated patients with a mortality of 85.7%.

Conclusion

The following conclusions were made from the present study:

(1) The age and the sex of the patient did not affect the morality of swine flu.
(2) Some comorbidities, such as DM, cardiac illness, and chronic chest illness, have no implication on mortality. However, renal conditions and the need for mechanical ventilation were associated with a high mortality rate in swine flu cases.
(3) If swine flu is complicated with bilateral severe pneumonia that necessitates mechanical ventilation, the mortality rate will be high.
(4) Influenza A (H5N1) is an infection characterized by fever, respiratory symptoms (shortness of breath, respiratory failure), abnormalities on chest radiograph, and a history of close contact with poultry.
(5) Women in the age group of 20–39 years had the greatest tendency to be affected with avian flu.
(6) Early hospitalization after infection will increase the chance of recovery. As result of the delay in reaching definitive care and administration of oseltamivir (Tamiflu), mortality will increase.
(7) Although fever was the most common symptom, 6.9% of swine patients and 21.7% of avian patients in our study did not have fever.

Final recommendation

(1) More efforts are needed to evaluate asymptomatic and mild cases of human influenza A.
(2) More efforts are needed to increase the awareness of the common population regarding the symptoms of the disease, as this may help avoid delayed presentation.
(3) Flu vaccine is recommended for people at high risk for developing flu complications.
(4) Widespread efforts to control the poultry outbreak and increased surveillance among poultry and humans should therefore be our highest priority for H5N1 influenza virus.

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