Investigation of House Birds Pathogens Related to Severe Respiratory Human Diseases

Maitham Sabah Sadiq*[1], Suhaib Khalid Ibrahim[2] and Ismael WaadUllah Ismael [3]

Middle Technical University / College of Health and Medical Techniques / Baghdad- Iraq.

Correspondence author Email (*) : **maithem.anaesthesia@gmail.com**

Abstract

Birds are susceptible to fewer zoonotic agents than mammals, reflecting the evolutionary distance between birds and humans. Birds provide the greatest risk of pathogen excretion, mainly those with a compromised immune system, young birds and those caught recently in the wild. To investigate the most common important pathogenic microbes in house birds saliva like bacterial, viral and fungal pathogens that cause severe respiratory tract infections among persons with direct contact. In this cross-sectional study, 100 saliva samples include 50 were collected from house birds (cock, pigeon and parrot) with 50 saliva samples were collected from persons with direct contact suffered from mild to severe respiratory diseases, then all samples were identified for avian influenza and cultured on special culture media for further bacterial and fungal isolation.The primary detection results revealed that there are many severe pathogenic microbes detected in saliva of different house birds like 44% avian influenza that reflect respiratory problems in 30% of patients in direct contact , 32% *Streptococcus pneumonia* that affect 16% of patients , 24% *Klebsiella pneumonia* that affect 14% in direct contact patients and other bacterial and fungal pathogens showed moderate and highly resistance to antibiotics like cefotaxime , vancomycin , tetracycline & imipenem .We can conclude that patients suffered from mild to severe respiratory tract diseases like pneumonia and severe distress syndrome are more susceptible to house birds pathogens by contacts via saliva or other body secretions determined in this study as a true causative agents for many pathogenic microbes .

Keywords: *Respiratory tract infections, severe respiratory distress syndrome, slide rapid diagnostic tests.*

التحري عن المسببات المرضية للطيور المنزلية وعلاقتها بخطورة امراض الجهاز التنفسي في الأنسان

م.م.ميثم صباح صادق[1] , م.م.صهيب خالد ابراهيم[2] وَ م.م.اسماعسل وعدالله اسماعيل[3]

الخلاصة

تعتبر الطيور واحدة من اهم الكائنات الحية التي قد تكون عرضة لبعض الأمراض الحيوانية الانتقالية للإنسان حالها حال الثديات , والتي تعكس الواقع التعايشي بين الطيور والأنسان . فالطيور تشكل نسبة خطورة عالية لانتشار المسببات المرضية المتمثلة بمختلف الجراثيم الميكروبية خاصة لدى الطيور البالغة التي عندها مشكلة او خلل وظيفي في جهازها المناعي والتي يتم مسكها في الطبيعة

P-ISSN: 2664-0562

E-ISSN:2664-0554

كطيور برية . للتحري والكشف عن انواع الميكروبات المرضية الاكثر انتشارا في عينة اللعاب الخاصة ببعض انواع طيور المنزل الأليفة مثل البكتريا , الفيروسات وبعض الفطريات الممرضة التي ممكن ان تتسبب في عدوى خطرة ومزمنة لجهاز التنفسي للإنسان المشارك في تغذيتها والملامس لها بصورة مباشرة . تم جمع 100 عينة لعاب كانت 50 منها قد تم جمعها من ثلاثة انواع من الطيور المنزلية الشائعة و50 عينة لعاب اخرى تم جمعها من الاشخاص الملامسين لهذه الطيور والذين كانوا يعانون من التهابات طفيفة الى حادة في المجاري التنفسية , حيث ان كل العينات تم تشخيصها بفحص خاص لأنفلونزا الطيور وزرع باقي العينات مختبريا على اطباق خاصة بالبكتريا وبعض انواع الفطريات . النتائج الاولية لهذه الدراسة اظهرت وجود عدة مسببات مرضية ميكروبية خطرة في لعاب مختلف الطيور المنزلية كتواجد 44% انفلونزا الطيور والتي عكست مشاكل تنفسية بنسبة 30% لدى المرضى الملامسين لها وكذلك تواجد 32% للمكورات السبحية الرئوية في لعاب الطيور مع 16% نسبة تأثيرها على المرضى الملامسين وعزلها من لعابهم وكذلك أيضا تواجد 24% للكلبسيلة الرئوية في لعاب الطيور وتأثيرها بنسبة 14% لدى المرضى الملامسين لهم بصورة مباشرة , كما اوضحت الدراسة أيضا هنالك عدد اخر من الميكروبات البكتيرية والفطرية والتي اعطت مقاومة متوسطة الى قوية لعدد من المضادات الحيوية كالسيفوتاكسيم , فانكومايسين , تيتراسايكلين و الاميبينيم . من بين المرضى التي اجريت عليهم الدراسة كانوا عددا منهم يعاني من امراض القناة التنفسية تراوحت من طفيف الى خطير جدا مثل ذات الرئة و متلازمة الضيق الشديدة حيث كانوا اكثر عرضة واتصال مباشر مع عدد من الطيور المنزلية الاليفة كالحمام والدجاج وبعض الببغاوات والمصابة عن طريق لعابها ورذاذ تنفسها وافرازات جسمها الاخرى التي دلت بشكل فعال في هذه الدراسة علاقتها الوثيقة مع الكثير من المسببات المرضية مثل انفلونزا الطيور الشبيهة بكورونا وكثير من المكروبات البكتيرية التي كانت سببا رئيسيا لذات الرئة وغيرها من التهابات الصدر التنفسية لدى المرضى المصابين .

الكلمات المفتاحية: *عدوى القناة التنفسية Respiratory tract infections , متلازمة الضيق التنفسي الحاد severe respiratory distress syndrome , فحص الشريحة التشخيصي السريع slide rapid diagnostic tests .*

Introduction

Zoonosis is the name for illnesses that affect both people and animals. The infectious agents may be viral, protozoan, bacterial, or fungal. Age, general health, and immune status of human hosts all affect the severity of the disease (immune-deficient or immunosuppressed patients experience more severe disease). The virulence of the organism, the infective dosage, and the method of infection all have an impact on how severe the disease is in people [1].

Humans, as well as other mammals, can infrequently contract avian influenza viruses, usually following intimate contact with diseased birds. Some viruses can cause serious illness, even though infections in people are frequently restricted to conjunctivitis or moderate respiratory conditions. Since 1997, there have been nearly 850 laboratory-confirmed cases of infections with Asian lineage H5N1 HPAI viruses that can be fatal [2]. There are about 110 zoonotic illnesses, some of which are fatal pathogens. Campylobacter species, *Coxiella burnetii*, Toxoplasma species, *Escherichia coli O157*, Cryptococcus species, avian flu, Mycoplasma, klebsiella, Gram positive cocci, and a number

P-ISSN: 2664-0562
E-ISSN:2664-0554

of fungi are just a few of the pathogens that can spread from pigeon meat that hasn't been properly chilled or cooked to humans or through inhaling dust. Likely, *Chlamydia psittaci*, along with parrots, doves, and mynah birds, is the most common zoonotic causative agent that causes psittacosis to have its origins in pigeons [3,4].

Chlamydia can be spread through the respiratory system by inhaling aerosolized particles from infected droppings, nasal secretions, contaminated tissues, and feathers [5].

Avian influenza viruses are extraordinarily varied, highly contagious, and common in birds. Although it is believed that wild birds in aquatic areas are their natural reservoir hosts, farmed chickens and other birds can also contract the disease [6,7].

The majority of viruses, also known as low pathogenic avian influenza (LPAI) viruses, only cause minor illness in poultry. Certain LPAI viruses have the potential to evolve into highly pathogenic avian influenza (HPAI) viruses, typically while they are circulating in poultry flocks [8].

Patients, Materials & Methods

1- Collection of samples (birds and human)

In this cross-sectional study, 100 saliva samples were collected from birds and patients with direct contact suffered from mild to severe respiratory diseases, fifty saliva collected from 30 cock, 15 pigeon and 5 parrots. Fifty saliva samples were collected from persons in direct contact with those birds, these samples were collected from rural area in different Baghdad houses at a period of October to December 2022.

2-Viral diagnosis

All saliva samples previously collected from patients and birds were directly manipulated in the laboratory and diagnosed for detection of viral antigens by slide rapid diagnostic tests (RDTs) by using influenza (A, B) rapid antigen detection kit (onSite Biotech, USA) and the results were showed after few minutes qualitatively as positive or negati

3- Bacterial and fungal cultivation

All saliva samples were cultured on different bacterial and fungal media like blood agar, MacConkey media for identification of gram positive and negative bacteria, Sabourauds dextrose agar for fungal cultivation such as Histoplasma, yeast extract agar for isolation of mycoplasma and nutrient agar for antibiotic sensitivity tests.

P-ISSN: 2664-0562
E-ISSN:2664-0554

4-Antibiotic Sensitivity Tests

The antibiotic susceptibility of bacterial isolates only were determined by Kirby–Bauer disk diffusion method. Suspension of each type of isolates spread on the surface of nutrient agar media by sterile glass rods, then four types of antibiotic discs (cefotaxime CTX, vancomycin VA, tetracycline TE and imipenem IPM) were placed onto the surface of the inoculated nutrient agar plate, the plate then incubated at 37°C for 24 hr. Antimicrobial susceptibility was determined by measuring the diameter of the inhibition zone according to clinical laboratory standard institutes (CLSI) [9].

Statistical analysis

Data were analyzed statistically in cross-sectional study through (SPSS) version (25.0) by chi-square and t-test, in order to calculate the correlation between frequency of birds isolated pathogens and human respiratory infections. *P* values < 0.05 were statistically significant.

Results

Table (1): Distribution of different pathogens isolated from saliva of house birds and contact patients.

Type of pathogen	Birds isolated	Patients affected	*p-value*
	No.%	No.%	
Avian influenza (A,B)	22(44)	15(30)	
Mycoplasma pneumoniae	5(10)	1(2)	
Klebsiella pneumoniae	12(24)	7(14)	
Staphylococcus spp.	10(20)	0(0)	
Streptococcus pneumoniae	16(32)	8(16)	
Chlamydia	8(16)	3(6)	
Aspergillus	11(22)	1(2)	0.00009 HS*
Histoplasma	16(32)	1(2)	
Total	50(100%)	50(100%)	

**p-value* < 0.01 considered statistically highly significant (HS)

The result of this table showed very high statistically correlation between the frequency of pathogenic microbes isolated from birds and person affected by avian respiratory illnesses were about 30% patients infected by avian flu from 44% birds flu isolated, 16% infected patients by *Streptococcus pneumoniae* from 32% birds isolated. 14% infection with *klebsiella pneumoniae* from 24% birds isolated, 6% Chlamydia infection from 16% birds isolated, only 2% infection to each of Histoplasma, Aspergillus and *Mycoplasma pneumoniae* from 32%, 22% and 10% birds pathogens

P-ISSN: 2664-0562
E-ISSN:2664-0554

isolated respectively with no any Staphylococcus species infection from 20 birds isolation at *p. (*0.00009) HS.

Table (2): Antibiotic resistance pattern of bacterial pathogens.

Type of pathogen	Antibiotic resistance of microbes in birds and human %							
	In birds				In human			
	CTX	VA	IPM	TE	CTX	VA	IPM	TE
Mycoplasma	50%	80%	100%	20%	66%	82%	100%	33%
Klebsiella	22%	2%	11%	43%	31%	1%	32%	78%
Staphylococcus	69%	6%	3%	58%	77%	21%	7%	88%
Streptococcus	77%	1%	0%	26%	90%	3%	3%	43%
Chlamydia	70%	4%	1%	90%	80%	4%	2%	91%
Total of R%	58%	19%	23%	47%	69%	22%	29%	67%
p-value	0.89 NS *							

The antibiotic sensitivity tests of bacterial isolates in our study was measured by Kirby–Bauer disk diffusion method and showed moderate increase in antibiotic resistance pattern in persons with direct house birds contact and affected by respiratory distress syndrome complications with the total resistance to 4 types of antibiotics in human isolates as 69% CTX , 67% TE , 29% IPM , 22% VA from 58% CTX , 47% TE , 23% IPM , 19% VA birds isolated respectively , at (*p.* 0.89*)* statistically non- significant correlation.

Discussion

Wild and house birds could be dangerous because can able to carry and transmit multiple pathogenic microbes in its mouth and intestine causing to human with direct contact moderate to severe respiratory distress diseases like corona by birds aerosols infected with avian flu and by fecal oral route can cause diarrhea by many bacterial enteric pathogens [10], such house birds that included in this study were distributed as 30 cocks, 15 pigeons & 5 parrots. The current study showed that there are several pathogenic microorganisms distributed among house birds (cocks , pigeon and parrots) and can be diagnosed in vitro by several techniques , as these pathogens may by viral , bacterial and fungal origin and can transmit to human by infected respiratory droplets or via close contact resulting frequently in a severe respiratory complicated syndromes characterized by pneumonia , difficulty to breathing , headache , fatigue and high body temperature , among these pathogens with the most avian influenza (A,B) in about 44% carrier in birds and 30% infected patients with direct contact , 32% birds *Streptococcus pneumoniae* with 16% human infection , 24%

P-ISSN: 2664-0562
E-ISSN:2664-0554

Klebsiella pneumoniae isolated from birds mouth and 14% pneumonic affected patients , 16% chlamydia in birds and only 6% human infected , 32% Histoplasma , 22% Aspergillus , 10% *Mycoplasma pneumonia* with only 2% close contact human infection to each one respectively , in addition to 20% staphylococcus colonization in birds with no any infection among close contact persons , these study results regarding the frequency of deleterious pathogens in birds with transmissible zoonotic diseases to humans are in agreement with review study of *A. Contreras , et al* . that published in Spain 2016 [11] and whose results reported that birds play important role in the epidemiological transmission and maintenance of zoonosis particularly those that transmitted to human by respiratory route like avian flu, Chlamydia and other microbes and those cause gastrointestinal disorders that transmitted by direct fecal oral position like salmonella and others. Another study by Sotirios *Tsiodras, et al*. in 2007 reported by British infection society, whose results did not agree with this study results and reported that wild birds carry several pathogenic microbes about 10 types were viral and bacterial origin while only one case transmitted from birds to human [12]. Four types of antibiotics including narrow and wide range spectrum were directed against both gram-positive and gram-negative bacteria in order to detect the resistance percentage of bacterial pathogens in both birds and humans , from our results the total resistance percentage of antibiotics against isolated pathogens from house birds were 58% cefotaxime , 47% tetracycline , 23% imipenem , 19% vancomycin while the antibiotic resistance in patients with closed contact were 69% cefotaxime , 67% tetracycline , 29% imipenem , 22% vancomycin with slightly increasing in antibiotic resistance range, these results also showed complete resistance of mycoplasma to vancomycin in both groups due to its considered cell wall less bacteria , the resistance of klebsiella to tetracycline showed moderate to high in 43% in birds and 78% in humans also chlamydia in this study showed only high resistance to cefotaxime & tetracycline in both study groups , finally most other gram positive and negative bacteria are highly susceptible to vancomycin and imipenem . These study results regarding antibiotic resistance was agreed with study results of J. *Bonnedahl & J. D. Järhult* whose results reported that there are many bacterial pathogens isolated from wild birds showed a very high resistance rate to several types of antibiotics [13].

P-ISSN: 2664-0562
E-ISSN:2664-0554

Conclusions

Pathogenic microbes can be transmitted from infected house birds to persons in close skin contact via inhalation of infected respiratory droplets , aerosols and by food contamination, that are able to transmit mild to severe respiratory distress diseases affecting the lung pneumonia caused by *Mycoplasma pneumonia*e with several gram positive and gram bacterial pathogens which is characterized by high antibiotic resistance pattern particularly to cefotaxime (CTX) and moderate resistance to tetracycline (TE) , with very low resistance to both vancomycin (VA) & imipenem (IPM) which is considered the best effective drug that inhibit most bacterial pathogens, among the only four types of antibiotics been used.

Recommendations

In future more phenotypic and genotypic studies should be conducted to several wild and house birds infected with different pathogenic microbes that transmitted to human with close contact in house or environments via respiratory route or fecal oral enteric microbes like certain viral , bacterial and fungal microbes enforced by several biochemical tests , biofilm assay and modern molecular DNA extraction , conventional and real-time PCR for highly specific detection and quantification of highly resistant strains of pathogenic microbes .

P-ISSN: 2664-0562
E-ISSN:2664-0554

References

1. Md Zulfekar Ali. Avian zoonotic diseases. *Biological Science*. 2013 DOI:10.13140/RG.2.1.2112.1127.

2. Alexander J. Millman, et al. Detecting Spread of Avian Influenza A(H7N9) Virus Beyond China. Emerg *Infect Dis*. 2015; 21(5): 741–749. doi: 10.3201/eid2105.141756.

3. Dudzic, A., Urban-Chmiel, R., Stępien-Pysniak, D., Dec, M., Puchalski, A., Wernicki, A. Isolation, identification and antibiotic resistance of Campylobacter strains isolated from domestic and free-living pigeons. *British Poultry Science*.2016;57(2);172–178. DOI: 10.1080/00071668.2016.1148262.

4. Daniel Haag-Wackernagel, Andreas J Bircher. Ectoparasites from feral pigeons affecting humans. *Dermatology*. 2010; 220(1): 82–92. DOI: 10.1159/000266039.

5. Belchior E., Barataud D., Ollivier R., Capek I., Laroucau K., De Barbeyrac B. & Hubert B. Psittacosis outbreak after participation in a bird fair, Western France, December 2008. *Epidemiol. Infect*. 2011;139(10):1637-41. DOI: 10.1017/S0950268811000409.

6. Samah Mosad Mosad, et al . Pathological and Molecular Characterization of H5 Avian Influenza Virus in Poultry Flocks from Egypt over a Ten-Year Period (2009–2019). *Animals*. 2020;10(1010): 1-14. doi: 10.3390/ani10061010.

7. Fouchier RA, Munster VJ. Epidemiology of low pathogenic avian influenza viruses in wild birds. *Rev Sci Tech*. 2009;28(1):49-58. DOI: 10.20506/rst.28.1.1863.

8. Swayne DE. Understanding the complex pathobiology of high pathogenicity avian influenza viruses in birds. *Avian Dis*. 2007;51(1 Suppl):242-249. DOI: 10.1637/7763-110706-REGR.1.

9. Melvin P. Weinstein, James S. Lewis. The Clinical and Laboratory Standards Institute Subcommittee on Antimicrobial Susceptibility Testing: Background, Organization, Functions, and Processes. *J Clin Microbiol*. 2020; 58(3):1-7. doi: 10.1128/JCM.01864-19 .

10. S. A. Hamer, E. Lehrer and S. B. Magle. Wild Birds as Sentinels for Multiple Zoonotic Pathogens Along an Urban to Rural Gradient in Greater Chicago, Illinois . *Zoonosis and Public Health*. 2012;59(5):355-64. DOI: 10.1111/j.1863-2378.2012.01462.x.

11. A. Contreras, et al. Epidemiological role of birds in the transmission and maintenance of zoonosis. *Rev. Sci. Tech*. 2016;35(3):845-862. DOI: 10.20506/rst.35.3.2574.

12. Sotirios Tsiodras, et al. Human infections associated with wild birds. *Journal of Infection*. 2008;56(2):83-98. DOI: 10.1016/j.jinf.2007.11.001.

13. J. Bonnedahl & J. D. Järhult. Antibiotic resistance in wild birds. *Ups J Med Sci*. 2014 May; 119(2): 113–116. doi: 10.3109/03009734.2014.905663.

P-ISSN: 2664-0562

E-ISSN:2664-0554