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Review Article

Parasitic Infections and Cancer: A Status Report

Abstract

There are many tropical parasitic infections that are still present public health problem in tropical medicine. Of interest, some diseases are proved for the relationship with carcinogenesis. Many cancers are proved for the etiopathogenesis due to parasitic infections. The well-known tropical parasitic infections that can induce carcinogenesis are opisthorchiasis, clonorchiasis, and schistosomiasis. To prevent parasitic infection related cancer is an important consideration in clinical oncology. The standard practice is the prevention of the infection, but the hope is the development of the new vaccines for cancer prevention. Here, the authors briefly review on the current status on the cancer vaccines against the three important tropical diseases that can result in cancers, opisthorchiasis, clonorchiasis, and schistosomiasis.

Keywords: *Cancer, clonorchiasis, opisthorchiasis, parasite, schistosomiasis, vaccine*

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Introduction

Cancer is an important problem at present. Of several causes of cancer, infection is the important underlying factor. The well-known situation is the papillomavirus infection that can result in carcinogenesis.[1] At present, the cancer vaccine against papillomavirus infection-related cancer, cervix cancer, is available and used worldwide.[2] Nevertheless, there are also other infections that can induce the cancers. The forgotten group of problematic infections is the parasitic infections. In fact, there are many tropical parasitic infections that are still present public health problem in tropical medicine.[3] Of interest, some diseases are proved for the relationship with carcinogenesis.

Many cancers are proved for the etiopathogenesis due to parasitic infections. The well-known tropical parasitic infections that can induce carcinogenesis are opisthorchiasis, clonorchiasis, and schistosomiasis. Opisthorchiasis and clonorchiasis are proved as the causes of hepatobiliary cancer.[4,5] Schistosomiasis is proved as the cause of urinary tract cancer, especially for urinary bladder cancer.[6] To prevent cancer due to the parasitic infection is the important consideration in oncology. The standard practice is the prevention of the infection, but the hope is the development of the new vaccines for cancer prevention. Here, the authors briefly review on the current status on the cancer vaccines against the three important tropical diseases that can result in cancers, opisthorchiasis, clonorchiasis, and schistosomiasis.

Vaccine for Opisthorchiasis and Opisthorchiasis-Related Cholangiocarcinoma

Opisthorchiasis is the liver fluke infection. The main pathogenic species is the *Opisthorchis viverrini*. This infection is very common in tropical Indochina in Southeast Asia. The chronic opisthorchiasis is proved for a relationship with cholangiocarcinoma carcinogenesis.[5] Of interest, the extremely high incidence of cholangiocarcinoma can be seen in Indochina.[7] The patients usually present with severe hyperbilirubinemia, and the disease is usually advanced.[8] High fatality can be seen. The infection usually starts with consumption of raw fish dishes contaminated with parasitic metacercaria and the food sanitation is widely promoted in the endemic area.[9] Nevertheless, it is still not successful for disease control.[7]

The new cancer vaccine is the hope for the management of opisthorchiasis-related cholangiocarcinoma.[10] There are some reports on vaccine development from research centers in the tropical areas. Most reports are on the finding of the epitopes

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based on the parasitic composition that can be further used for vaccine development.[11] Nevertheless, there are already reports on the trial of newly developed vaccine as a therapeutic vaccine against cholangiocarcinoma. The interesting report is on the development of personalized peptide vaccine against cholangiocarcinoma.[12] Löffler *et al*. reported the success in the development of personalized peptide vaccine for the treatment of a patient with cholangiocarcinoma.[12]

Vaccine for Clonorchiasis and Clonorchiasis-Related Cholangiocarcinoma

Clonorchiasis is also a liver fluke infection, but the pathogen is the *Clornorchis spp*. This infection can be chronic and can also result in cholangiocarcinoma carcinogenesis.[13] The same mode of infection acquiring is by intake of poorly cooked contaminated fish dishes, same as the case of opisthorchiasis. Similar to opisthorchiasis, there are some ongoing researches on vaccine finding against clonorchiasis-related cholangiocarcinoma.[14] The finding and approval of immunogenicity property of the heat shock proteins 70 and 90 from the parasite is the hope for further vaccine development.[15] In addition, some ongoing researches are also performed regarding cysteine protease of *Clonorchis* spp., which is proposed as another important target for vaccine development.[16]

Vaccine for Schistosomiasis and Schistosomiasis-Related Urinary Bladder Cancer

Schistosomiasis is blood fluke infection caused by pathogenic *Schistosoma* spp. The urinary schistosomiasis, by *Schistosoma haematobium* infection, is proved for the urinary tract carcinogenesis induction.[6] This disease is highly endemic in tropical Africa and becomes the big public health problem. In tropical Asia, this infection is sporadically seen.[17] For disease prevention, finding for new vaccine is the present hope. There are some ongoing researches on vaccine finding against schistosomiasis-related cancer.[18,19] Hsieh *et al*. noted that the vaccine against schistosomiasis would be available within a few years and would be the third vaccines against the infections that could result in carcinogenesis, following hepatitis B vaccine and human papillomavirus vaccine.[19] The interesting focus for vaccine development is protein of the mansoni parasite that is approved for immunogenicity property against *Schistostoma* spp.[20,21] For human vaccine, a recent publication in 2017 mentioned that there will be a human trial on new vaccine candidate, "Sm-p80-Based Schistosomiasis vaccine" which will be an important step in the development of vaccine against schistosomiasis and schistosomiasis cancer.[22]

Conclusion

Although it has been known for many years that some parasitic infections can induce carcinogenesis, there are few researches for the development of new cancer vaccines against those parasitic infections. Since those parasitic infections are usually endemic in poor tropical endemic countries and there are usually limited budget and grant for research on the cancer vaccines regarding those neglected tropical diseases, the success in vaccine development might not be available soon. It is necessary to call for research and development on the vaccine for parasitic diseases with carcinogenesis property.

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Conflicts of interest

There are no conflicts of interest.

References

1. Vyshenska D, Lam KC, Shulzhenko N, Morgun A. Interplay between viruses and bacterial microbiota in cancer development. Semin Immunol 2017;32:14-24.
2. Viarisio D, Gissmann L, Tommasino M. Human papillomaviruses and carcinogenesis: Well-established and novel models. Curr Opin Virol 2017;26:56-62.
3. van Tong H, Brindley PJ, Meyer CG, Velavan TP. Parasite infection, carcinogenesis and human malignancy. EBioMedicine 2017;15:12-23.
4. Machicado C, Marcos LA. Carcinogenesis associated with parasites other than *Schistosoma*, *Opisthorchis* and *Clonorchis*: A systematic review. Int J Cancer 2016;138:2915-21.
5. Prueksapanich P, Piyachaturawat P, Aumpansub P, Ridtitid W, Chaiteerakij R, Rerknimitr R, *et al.* Liver fluke-associated biliary tract cancer. Gut Liver. 2017. Doi: 10.5009/gnl17102. [Epub ahead of print].
6. Zaghloul MS. Bladder cancer and schistosomiasis. J Egypt Natl Canc Inst 2012;24:151-9.
7. Sripa B, Echaubard P. Prospects and challenges towards sustainable liver fluke control. Trends Parasitol 2017;33:799-812.
8. Wiwanitkit V. Clinical findings among 62 Thais with cholangiocarcinoma. Trop Med Int Health 2003;8:228-30.
9. Chai JY, Darwin Murrell K, Lymbery AJ. Fish-borne parasitic zoonoses: Status and issues. Int J Parasitol 2005;35:1233-54.
10. Buisson Y. Control of *Opisthorchis viverrini* infection for cholangiocarcinoma prevention. Bull Soc Pathol Exot 2017;110:61-7.
11. Wiwanitkit V. Finding for epitope within egg shell protein of human liver fluke: A clue for cholangiocarcinoma vaccine development. South Asian J Cancer 2014;3:142-3.
12. Löffler MW, Chandran PA, Laske K, Schroeder C, Bonzheim I, Walzer M, *et al.* Personalized peptide vaccine-induced immune response associated with long-term survival of a metastatic cholangiocarcinoma patient. J Hepatol 2016;65:849-55.
13. Kim TS, Pak JH, Kim JB, Bahk YY. *Clonorchis sinensis*, an oriental liver fluke, as a human biological agent of cholangiocarcinoma: A brief review. BMB Rep 2016;49:590-7.
14. Tang ZL, Huang Y, Yu XB. Current status and perspectives of *Clonorchis sinensis* and clonorchiasis: Epidemiology, pathogenesis, omics, prevention and control. Infect Dis Poverty 2016;5:71.
15. Chung EJ, Jeong YI, Lee MR, Kim YJ, Lee SE, Cho SH, *et al.* Heat shock proteins 70 and 90 from *Clonorchis sinensis* induce Th1 response and stimulate antibody production. Parasit Vectors

2017;10:118.
16. Wu Z, Tang Z, Shang M, Zhao L, Zhou L, Kong X, *et al.* Comparative analysis of immune effects in mice model: *Clonorchis sinensis* cysteine protease generated from recombinant *Escherichia coli* and *Bacillus subtilis* spores. Parasitol Res 2017;116:1811-22.
17. Wiwanitkit V. Overview of clinical reports on urinary schistosomiasis in the tropical Asia. Pak J Med Sci 2005;21:499-501.
18. Egesa M, Hoffmann KF, Hokke CH, Yazdanbakhsh M, Cose S. Rethinking schistosomiasis vaccine development: Synthetic vesicles. Trends Parasitol 2017;33:918-21.
19. Hsieh MH, Brotherton JM, Siddiqui AA. Hepatitis B vaccines and HPV vaccines have been hailed as major public health achievements in preventing cancer – Could a schistosomiasis vaccine be the third? PLoS Negl Trop Dis 2015;9:e0003598.
20. Carvalho GB, Pacífico LG, Pimenta DL, Siqueira LM, Teixeira-Carvalho A, Coelho PM, *et al.* Evaluation of the use of C-terminal part of the *Schistosoma mansoni* 200kDa tegumental protein in schistosomiasis diagnosis and vaccine formulation. Exp Parasitol 2014;139:24-32.
21. Tallima H, Dvořák J, Kareem S, Abou El Dahab M, Abdel Aziz N, Dalton JP, *et al.* Protective immune responses against *Schistosoma mansoni* infection by immunization with functionally active gut-derived cysteine peptidases alone and in combination with glyceraldehyde 3-phosphate dehydrogenase. PLoS Negl Trop Dis 2017;11:e0005443.
22. Siddiqui AA, Siddiqui SZ. Sm-p80-based schistosomiasis vaccine: Preparation for human clinical trials. Trends Parasitol 2017;33:194-201.