Schistosoma mansoni tegument proteins

Tran, M., Pearson, Bethony, J., Smyth, D., Jones, M., Duke, M., Don, T., McManus, D., Correa-Oliveira, R. and Loukas, A. (2006) ‘ Tetraspanins on the surface of Schistosoma mansoni are protective antigens against schistosomiasis’, Nature medicine., 12(7), pp. 835-40.

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Tetraspanins are family found within the tegument that has shown to be accessible to host immunoglobulin by proteomic analysis (Braschi *et al.* , 2006).

The surface membrane of B cells has tetraspanins, it is also found on the suface of the schistosome tegument Schulte et al. (2013).

Function of both schistosome tetraspanins and mammalian tetraspanins have similar function (Tran et al. (2013). Tran et al (2006) suggested that expression and purification of the extracellular loop 2 of both TSP- 1 and TSP-2 of S. mansoni with E. coli thioredexin as soluble proteins. This was done by a mice been immunised three times with rTSP-1 which is a recombinant. The count of the worm burdens, liver egg burdens and faecal egg was controlled and reduction was found in the counts. Due to the reduction of faecal egg count, a vaccine for schistosomiasis is achievable in which reduction of all the eggs in the environment is attained thereby reducing re-infection in the society. If the number of burden of faecal egg is reduced, it suggest that the symptoms linked with build up eggs in host is reduced. As seen using recombinant (rTSP-1) showed 34% reduction in worm burden through

vaccination. Also r(TSP-2) showed 57% reduction of worm burden with vaccination. Due to screening of of specific antibodies against the recombinant proteins in individual exposed to S. mansoni , levels of IgG3 and IgG1 with TSP-2 showed increased resistance in the individual in which IGe wasn’t recognised. IgE is shown to come into effect when there is parasitic infection; Tan et al. (2006) said that IgG3 and IgG1 with TSP-2 posseses protective characteistics which indicate that it could be an effective vaccine for scistosomiasis.

Aquaporin is another molecule found on the surface of schistosomes and there is a lot of the Aquaporin protein within the tegument of S. mansoni (Castro- Borges et al., 2011). SmAQP is found in both male and female worms whereby it enables nutrient transportation, drug uptake and osmoregulation (Faghiri et al., 2010). This led to scientist studying SmAQP whereby it has a chaacteristics of protecting the mice (Figueiredo et al. 2014). A chimeric form of SmAQP which is cSmAQP was made to conduct immunisation studies, whereby there was a control and mice injected with cSmAQP. This led to no worm burden been reduce and there was no reduction in parasite burden (Figueiredo et al., 2014). Figueiredo et al. (2014) suggested that when binding SmAQP to antibodies it doesn’t stop the protein protein from functioning.

The efficacy of S. mansori vaccine candidate Sm-p80 were measured using two methods. A prime boost vaccination strategy and a recombinant protein method. Both methods were carried out in the presence of a synthetic oligodeoxynucleotides (ODN). ODN contains unmethylated CpG dinucleotides as an adjuvant.

Firstly, C57BL/6 mice were immunised with a control prime-boost (100ug pcDNA3) and experimental prime boost (100 ug Sm-p80-pcDNA3). Also, Experimental recombinant protein (25ug rSm-p80 mixed with 50ug ODN) or the control recombinant protein (50ug ODN).

The results showed a significant worm burden in both groups. Mice immunised with the prime boost strategy had a 57% reduction whilst mice immunised using the recombinant strategy combined with ODN had a 70% reduction. Ahmad et al discovered there was also a 71% reduction in egg production in mice immunised with the prime-boost strategy and 75% reduction in egg production in mice immunised with the recombinant protein and ODN strategy.

Also, cercarial radiation attenuated vaccines (RA) has high levels of protection and this has been set as the standard for inducing protein in animal models. Some parts of the S. mansori tegument have been found to induce partial protection against schistosome challenge in animal models.

In a recent study conducted by Teixeira de Melo et al 2010, mice were immunised with the whole tegument of S. mantory, (Smteg).

Freuds adjuvant was used to immunise C57BL/6 mice. The mice were challenged with cercariae thirsty days' after the last injection. The results showed a significant reduction in the worm, liver egg and faecal egg burdens compared to the control group.

Teixeira de Melo et al. (2010) collected worms from the immunised mice and concluded that the worms were physically impaired indicating that the

teguments of schostosomes were damaged. Additionally, all the eggs collected from faeces were dead however, it is unclear as to which of the specific protein contributed towards this protective immunity characteristic.

3. 2

In a study perfomed by Cao X. et al (2014), two independent group of BALB/c mice were immunised with recombinant SjPDI with Montanide ISA 206 VG adjuvant and challenged with cercariae. The protective efficacy was evaluated. The result found showed a reduction of 35. 32% and 26. 19% when compared with control groups. 33. 17% and 31. 7% decrease in egg counts were also noticed.

The protein SjNPP-5 from the family of nucleotide phosphodiesterase family (NPPs) was studied as a vaccine target. This protein is responsible for various types of physiological processes. (Rofatto et all 2009). In further research, Zhang et al (2011) tested the efficiency of this protein as a vaccine target. This was achieved by immunising ten BALB/c mice with recombinant SjNPP-5. The mice were then challenged with cercariae. The result showed a reduction in worm of 29. 9% and there was a 26. 21% reduction of liver egg count. The test shows that the protein possesses good immunogenicity and an increased level of specific antibodies.

Lv et al 2009 tested a calcium-binding protein from the tegument of S japonicum for its ability to protect mice against schistosomiasis infection. Eight mice were immunised with SJCa8 and was dissolved in PBS with Freuds adjuvant. The mice were also challenged with S. janonicum cercariae. Immunised mice were compared to controlled mice. The results showed a

reduction of 50. 39%. this results could signify that the calcium-binding protein SjCa8 may make a suitable vaccine for the minimization of the pathogenesis of schistosome infection.

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Yan et al (2005) used sera from M. fortis to screen and adult japonicum cDNA library for the identification of antigens that evoke protective response in M. fortis. Some of the clones identified by cDNA library screening partially encoded a member of the serine proteinase inhibitor. A full-length sequence encoding this protein was extracted.

The S japonicum serpin (Sj serpin) was used to immunise C57BL/6 mice. The mice were also challenged with cercariae 3 weeks after the last boosting. Reduction of 34-36% in worm burdens was noticed. Also, Egg counts had a 39-40% reduction compared to the controlled group. Overall, the test for Sj serpin was lower than 40% therefore is not considered an effective protein antigen.

Furthermore, Hong et al 2015 analysed proteins recognised by susceptible (mice) and resistant (M. fortis) antibodies before and after schistosome infection using comparative immunoproteomics. Hong proposed that proteins recognised by the resistant M. fortis sera would be effective vaccines on the other hand, proteins recognized by both resistant and susceptible would be suitable for diagnostic purposes.

a heat shock protein known as DnaJ was recognized by sera from the M. Fortis (resistant). Hong et la 2015 conducted a vaccination of mice with the

recombinant form of Dnaj derived from schistosome japonicum. The results showed a reduction in worm burdens 34. 5% and reduction of liver egg count 48. 9% in the immunised mice. This illustrates that this molecule induce partial protection against S. japonicum. overall, it can be concluded that SjDna is not an effective protein antigen.

3. 3

Schistosoma haematobium tegument proteins

Research into schistosomiasis haematobium vaccine generally has been inconclusive. Moreover, recently, a 23kDa antigen from the member of a tetraspanin family has been analysed for its potential vaccine target in S. haematobium (inal and Bickle 1995).

Mice in this study were immunised with large hydrophilic domain of Sh23 as a fusion with glutathione S-transferase. The mice were challenged with cercariae. After 8 weeks, the mice were infused. Evidence of worm burden reduction was not seen.

Golden Syrian hamsters were vaccinated with recombinant Sm-p80. When challenged with schistosomiasis haematobium carcariae, there was a reduction of 48% in worm burden and 66% in liver egg burden. 63% reductions in intestinal egg retention were also discovered. Karmakar et al 2014, concluded that this was not a suitable model for studying the pathogenesis of schistosomiasis haematobium. The reason provided was due to the fact that there were no eggs detected in the urinary bladder of the vaccinated or control group.

Similarly, baboons were used for immunisation experiments. The baboons were also immunised with the same combination of Sm-p80. The baboons displayed no reduction in urinary bladder egg load. There was a 40% reduction of faecal egg and a 53% reduction of urine egg. This result may indicate that Sm-p80 could be effective against both urinary and intestinal schistosomiasis. Karmakar et al 2014

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