

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

1: Progesterone Induces Mucosal Immunity in a Rodent Model of Human Taeniosis by *Taenia solium*

Taenia solium grows in experimentally infected hamsters. An inflammatory reaction in the intestinal mucosa surrounding the scolex of the worms is produced. We searched for mRNA of Th1 and Th2 cytokines by in situ hybridization in intestinal biopsies.

This is an open access article distributed under the Creative Commons Attribution License , which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. Abstract Human neurocysticercosis by *Taenia solium* is considered an emergent severe brain disorder in developing and developed countries. Discovery of new antiparasitic drugs has been recently aimed to restrain differentiation and establishment of the T. Tamoxifen is an antiestrogenic drug with cysticidal action on *Taenia crassiceps*, a close relative of T. Thus, we evaluated the effect of tamoxifen on the in vitro evagination and the in vivo establishment of T. In vitro, tamoxifen inhibited evagination of T. These results demonstrate that tamoxifen exhibits a strong cysticidal and antitaeniasic effect on T. Introduction Human neurocysticercosis by *Taenia solium* is considered a serious brain disorder in developing countries [1], with an alarmingly increased number of new cases in developed industrialized nations [2]. Furthermore, it has been estimated that around 0. The parasite life cycle takes place in both pigs and humans [4]. In this way, pigs develop the intermediate larvae stage of T. After a subject ingests undercooked contaminated pork meat, the T. Once this tapeworm has developed gravid mature proglottids, thousands of eggs are released with the stools into the environment, where they will be capable to infect free-ranging boars, maintaining the parasite life cycle [1 , 5]. In parallel, neurocysticercosis can be acquired by humans once they have been accidentally exposed to stools containing T. For this reason, discovery of new anti-taeniosic drugs should be aimed to restrain differentiation, establishment, and egg production of the T. Tamoxifen is a competitive antagonist of the estrogen receptor that has been widely used for treating breast cancer in premenopausal women and gynaecomastia in men receiving hormonal therapy for prostatic carcinoma [8 , 9]. Interestingly, the use of this antiestrogenic drug has also proved to be effective against several protozoan parasites, including *Leishmania major*, L. Nevertheless, the tamoxifen effect upon helminth cestode parasites has been exclusively studied for the case of *Taenia crassiceps*, the causal agent of experimental murine cysticercosis [14]. Actually, tamoxifen inhibits T. Thus, we evaluated the effect of tamoxifen on *Taenia solium*, focusing on several important aspects of the adult tapeworm stage, including differentiation from cysticercus to worm on in vitro cultures, and establishment of the intestinal tapeworm using the hamster model for experimental taeniosis in vivo. This paper could contribute to the search and design of novel therapeutic agents for the control of cysticercosis and taeniosis in livestock and humans. Materials and Methods 2. Pigs sacrifice to obtain parasites was performed under sodium pentobarbital anesthesia, and all efforts were made in order to minimize suffering. The fibrous capsule surrounding each cysticercus was carefully separated under a dissection microscope. Baker to the desired stock concentration. Stock solutions were sterilized by passage through a 0. For concentration-response curves, the experimental design was as follows: Control parasites were incubated either in presence of 0. For time-response curves, cysticerci were incubated in presence of increasing doses of tamoxifen 0. Both concentration and time-response experiments were daily inspected for scolex evagination and worm growth using an inverted microscope at 4 and 10X magnification Olympus, MO21, Tokyo. Worm growth was considered as the millimeter sum of scolex, neck, and strobila, as we previously reported [20]. Each single dose of tamoxifen was diluted in saline solution 0. Two different groups of control animals were used in all of our experiments, as follows: Tamoxifen and vehicle administration was carried out each other day for 4 weeks, in order to maintain a constant serum concentration for the entire time of the experiment. Animals were fed with Purine Diet Purine, St. Louis, MO and water ad libitum. Oral Infection Experiments Two weeks after the beginning of the drug administration, tamoxifen, vehicle, and control animals were orally infected with four viable T. All of the animals were euthanized 15

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

days postinfection, using a CO₂-saturated chamber. Under a stereoscopic microscope, the lumen of the small intestine was carefully exposed by making a longitudinal cut using a sterile dissection scissor. Duodenum-anchored parasites were then counted and measured with a calibrator. Cell Culture and Lymphoid Proliferation Total leukocytes and red blood cells were individually extracted from the mesenteric lymph nodes of all of the animals. The OD_{490} nm lecture coefficient was employed to assess the proliferation index. Cytokine Expression Spleen and scolex-associated duodenal tissue were placed in Trizol reagent Invitrogen, Carlsbad, California. Total RNA extraction was as follows: The aqueous phase was recovered after 15 min of centrifugation at rpm, and treated with a same volume of isopropyl alcohol for RNA precipitation. RNA concentration was determined by absorbance at nm, and its purity was verified after electrophoresis on 1. The relative expression rate of each amplified gene was obtained by optical density analysis OD , using the 18S-ribosomal RNA as constitutive control of expression. Primers used for amplification of hamster-specific genes. Primer sequence as well as molecular weight expected of the PCR product is shown. Histological Examination of Inflammatory Infiltrate It has been previously reported that hormone-associated factors are able to induce an intestinal inflammatory response associated with T. We then analyzed a possible tamoxifen-induced intestinal inflammatory response related to control of the parasite load. Sections were stained with hematoxylin-eosin for evaluating the inflammatory infiltrate degree on each sample, considered as number of polymorphonuclear leukocytes per ten microvilli, using an optical microscope at 40 and x magnification Nikon Microphot-FXA Microscope. Statistical Analysis The in vitro and in vivo assays were performed in two independent experimental series. After evaluation of the normal distribution of data by means of the Shapiro-Wilk test, one-way analysis of variance ANOVA , and the Tukey post-hoc test were performed to determine significant differences among groups. Differences were considered significant when. Results Tamoxifen exhibited a strong cysticidal effect on *Taenia solium* larvae in vitro. As compared with controls, the use of 0. Tamoxifen inhibits the in vitro evagination and development of *Taenia solium* cysticerci in a concentration-dependent manner. Tamoxifen was dissolved in 0. Total accumulative results at twentieth day of in vitro culture are shown. Data were pooled from two independent experiments using cysticerci obtained from two different pigs. Control cysticerci displayed a spontaneous evagination after two days of in vitro culture, reaching a plateau at eighteen day Figure 2 a. On the contrary, parasites exposed to 0. Similarly, in vitro differentiated worms reached a mm length under control conditions, while cysticerci differentiated in presence of the lowest tamoxifen concentration showed a mm maximum length Figure 2 b. Once again, increasing concentrations of tamoxifen induced a significant delay in the parasite development onset, accompanied by a progressive diminution in the growth of in vitro differentiated worms Figure 2 b. Notably, since no difference between control groups were observed, we assume that addition of 0. Tamoxifen inhibits the in vitro evagination and development of *Taenia solium* cysticerci in a time-dependent manner. In vivo, tamoxifen exerted a protective effect against the T. Furthermore, while vehicle-treated and control animals had between 3 and 4 viable tapeworms associated to the host duodenal mucosa, tamoxifen-treated hamsters showed no more than 1 or 2 poorly developed parasites Figure 3 a. Indeed, tapeworms from both control groups reached a maximum length of mm Figure 3 b , exhibiting well differentiated rostellum, suckers, and strobila data not shown. In contrast, parasites from tamoxifen-treated hamsters did not grow up more than mm in length Figure 3 b , frequently appearing as scolices without strobilar development. Tamoxifen impairs the in vivo establishment of *Taenia solium*. Data were pooled from two independent experiments using ten animals per group in each experimental series and cysticerci obtained from two different pigs. In order to determine a possible mechanism through which tamoxifen could exert its protective role during the experimental taeniosis in hamsters, total leukocytes from mesenteric lymph nodes were assayed for antigen-specific proliferation Figure 4. Interestingly, there were no significant differences in the lymphoid proliferation rate between tamoxifen-treated animals and controls Figure 4. Evaluation of the proliferation rate of antigen-specific immune cells. Proliferation rate was estimated after 48 hours under described conditions. No significant differences in the leukocyte proliferation rate were observed among experimental groups. As intestinal

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

inflammation has been related to parasite elimination, we decided to evaluate whether tamoxifen administration is able to induce recruiting of inflammatory cells into the host duodenal mucosa Figure 5. The duodenal tissue from tamoxifen-treated and control hamsters showed well defined intestinal microvilli on the mucosa, accompanied by a scant inflammatory infiltrate probably associated with parasite attachment Figure 5. No significant differences in the percent of infiltrated neutrophils, eosinophils, and basophils into the intestinal mucosa of tamoxifen-treated, vehicle-treated, and control animals were observed Figure 5. Histological assessment of the duodenal inflammatory infiltrate associated with the *Taenia solium* intestinal infection. Scolex-associated duodenal samples from tamoxifen-treated c , vehicle-treated b , and control a hamsters were stained with hematoxylin-eosin. The inflammatory infiltrate degree was considered as the number of polymorphonuclear leukocytes per ten microvilli. No significant differences in the inflammatory level of the intestinal mucosa were observed among experimental groups. It has been previously reported that hormone-associated factors can stimulate cytokine expression which in turn is associated with T. We then studied whether tamoxifen treatment could promote an immunostimulatory effect through inducing cytokine expression at the local and systemic levels. Nevertheless, expression of these cytokines was no significantly changed concerning tamoxifen-treated animals Figure 6. However, once again there were not significant differences in the spleen cytokine expression between tamoxifen-treated and control animals Figure 6. Expression levels of Th1 a , Th2 b , proinflammatory c , and anti-inflammatory cytokines d associated with the *Taenia solium* intestinal infection. Cytokine expression in duodenum and spleen tissue samples from tamoxifen-treated, vehicle-treated, and control hamsters was analyzed. However, no significant changes in this cytokine expression pattern were observed among experimental groups. Discussion To our knowledge, this study describes for the first time the effect of tamoxifen upon the in vitro evagination and the in vivo establishment of *Taenia solium*. Conventional drugs against intestinal taeniosis such as albendazole, praziquantel, or niclosamide exhibit numerous side effects in humans, as well as induction of drug-resistant parasite strains. Besides those inconvenient, these antihelminthic drugs have shown to be only effective as therapeutic agents but not in prophylactic schemes. Taking also into consideration that the adult tapeworm carrier has been now recognized as the central node in the maintaining of the disease dissemination to both humans and pigs [1 , 2 , 7], several research groups have then focused on designing new drugs and vaccines in order to prevent the intestinal establishment of T. In this sense, the S3PVac synthetic peptide vaccine protects hamsters orally exposed to T. Similarly, hormonal therapy with progesterone exhibits controversial results, inducing protection in vivo but stimulating parasite evagination and growth in vitro [20 , 21]. Interestingly, our results suggest that low concentrations of tamoxifen exhibit a strong cysticidal effect upon T.

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

2: Animal biodiversity and emerging diseases : prediction and prevention in SearchWorks catalog

Taenia solium grows in experimentally infected hamsters. An inflammatory reaction in the intestinal mucosa surrounding the scolex of the worms is produced. We searched for mRNA of Th1 and Th2.

Abstract The life cycle of *Taenia solium*, the pork tapeworm, is continuously closed in many rural settings in developing countries when free roaming pigs ingest human stools containing T. Cysticercosis of the human nervous system, neurocysticercosis, is a major cause of seizures and other neurological morbidity in most of the world. The dynamics of exposure, infection and disease as well as the location of parasites result in a complex interaction which involves immune evasion mechanisms and involutive or progressive disease along time. Moreover, existing data is limited by the relative lack of animal models. This manuscript revises the available information on the immunology of human taeniasis and cysticercosis. Here the worm grows by reproducing its cells at the neck level, developing segments or proglottids which mature as they become more distal to the scolex. These infective eggs are expelled to the environment with the feces of the tapeworm carrier. Once ingested by a suitable host usually the pig, the embryos contained in the eggs hatch, cross the intestinal wall, and are carried by the bloodstream to all body tissues where they establish as the larval stage or cysticercus. Humans get infected with cysticercosis via fecal oral contamination. Thus humans may have adult intestinal tapeworm taeniasis, or larval human cysticercosis infections, while pigs only act as intermediate hosts porcine cysticercosis. Seizures are the commonest clinical manifestation and in fact NCC is considered the major cause of adult onset seizures worldwide. Parasitic larvae located in the parenchyma of the brain most frequently manifest with seizures. They establish as viable cysts, and after an extremely variable period which may be decades follow an involutive process, driven by the attack of the immune response of the host. Unlike intraparenchymal NCC; subarachnoid disease is progressive and associated with significant mortality. Most if not all seroepidemiological studies have used antibodies to the cyst stage. Antibodies to the oncospherical stage, which should arise much early in the infection process, have been identified. How previous exposures to the parasite affect the likelihood of successful infection in further challenges is not known. Established infection Very likely most of the invading oncospheres are destroyed while passing through the liver, or early at arrival in non-immunologically privileged sites. Still, human infection is a frequent event which in most cases courses and resolves without obvious symptoms, as proven by the sizable proportion of people showing residual brain calcifications in endemic populations. Also there is basically no information on how many people could have cysticercosis in sites other than the nervous system in a population setting. Evolution of human neurologic and extraneural infection Available information on the evolution of human infections comes from large case series described more than a century ago. Patients with subarachnoid neurocysticercosis manifest with mass effects or intracranial hypertension at older ages. Overall, the fragmentary available information suggests that embryos get distributed by the circulatory system to all tissues, and survive preferentially in the nervous system where they can be alive for many years or even be the cause of progressive disease as it commonly occurs in subarachnoid NCC. Immune response by type of NCC In general, extraparenchymal NCC cysts in the ventricles or subarachnoid space is associated with high parasite antigen levels, an exuberant immune response expressed as very strong antibody reactions. Conversely, the degree of immune response in patients with only intraparenchymal lesions is dependent on the number and likely the volume of the lesions as well as their stage of involution. However, it rapidly became apparent that the acquired T cell response was mixed in the murine model of infection using T. Osteopontin may have a role in down-regulating the inflammatory Th1 response although other endocrine mediators including sex hormones may also be involved. Perilesional inflammation is a major contributor to seizures and other symptoms in intraparenchymal NCC. Soluble intercellular adhesion molecule sICAM -1 was elevated in patients with symptomatic neurocysticercosis. Although cytokines and other immune mediators are important in driving the pro-inflammatory response, tissue damage observed on CT scans and increased permeability of

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

the blood brain barrier implies the involvement of enzymes driving tissue destruction. The blood brain barrier is rich in type 4 collagen which is one of the substrates of matrix metalloproteinase MMP. The MMPs are a family of zinc-containing enzymes potentially able to degrade all components of the extra-cellular matrix. MMP-9 or gelatinase B has been associated with both breakdown of the blood brain barrier in the murine model of neurocysticercosis 85, 86 and there are data consistent with this observation from patient studies 87, 88. Of particular interest was the observation that the non-specific MMP inhibitor doxycycline reduced leukocyte-dependent inflammation in the murine model of neurocysticercosis. In intraventricular disease, parasites are usually cystic in nature spherical, most times with a visible scolex, and most of the clinical manifestations are caused by direct blockage of the CSF circulation and the resulting obstructive hydrocephalus. There is an associated inflammatory component and high dose steroids frequently contribute to improve the patient situation. Steroids should always be administered in the settings of appropriate control of intracranial hypertension and shunt placement where indicated. We have found that cyst fluid contains an anti-inflammatory IL-like mediator which is lost during inflammation associated with anti-parasitic therapy which results in increased pro-inflammatory chemokine secretion in response to scolex and membrane antigens. Lesions of both diseases tend to occur in the same hemisphere, and it is also assumed that NCC predisposes to more severe disease in Japanese encephalitis. Life span of the tapeworm. It was initially believed that the adult *Taenia solium* tapeworm lived for many years. This seems to have been based on anecdotal case reports most likely corresponding to other tapeworms. Clinical evidence do not support this claim. The tapeworm carrier is the person most exposed to infection, however only a few patients with NCC carry a tapeworm by the time of diagnosis. Epidemiological data also supports this concept. In the largest series of *Taenia solium* taeniasis infections published, Allan et al presented a curve of taeniasis prevalence by age which sharply decreases after age 30, where a sharp decrease in prevalence at a given age period is unlikely to occur in a long lived infection. Also, seizure cases do not cluster around tapeworm carriers reflecting a changing tapeworm population. Interaction with the host. The T. There is local damage and an inflammatory response which involves mast cells and goblet cells, and varied cell populations including plasma cells, lymphocytes, neutrophils and eosinophils. Our understanding of the specific mechanisms involved in this interaction is limited by the inherent variability of infections in terms of infective dose, number, size and location of the parasites with the consequent extreme variability of its clinical expression, the very high frequency of exposure of individuals and animals to the parasite in endemic regions, the long period between infection and disease, and also by the lack of appropriate animal models.

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

3: Are Basophils Important Mediators for Helminth-Induced Th2 Immune Responses? A Debate

*In conclusion, we describe a bipolar cytokine profile early during experimental infection of hamsters with adult *T. solium*, followed by down regulation of the pro-inflammatory cytokine IL in the intestinal mucosa and discuss the interplay between pro- and anti-inflammatory branches of the immune response to *T. solium*.*

Worth of mention is the prominent proliferation rate of T lymphocytes in presence of T. Although both possible explanations are intriguing, they require further experimental analysis. On the other side, progesterone was able to locally over-regulate proinflammatory and Th2-related cytokines expression. As we have previously shown, the immunomodulatory effects of progesterone on several peripheral immune cell types have been widely described [43 , 45 , 58 , 59]. Nevertheless, its regulator role upon mucosal immunity has been scarcely studied [60 - 62]. Expression of these cytokines has been associated to parasite elimination in this animal model [63]. Then, progesterone could improve protection from T. In turn, these cytokines could promote an exacerbated inflammatory reaction with enormous capacity to affect parasite establishment and growth through the activation of eosinophil, basophil and, importantly, mast cells. Of additional interest is the possible direct role of progesterone upon these immune cell types associated to the mucosa. For instance, during human chronic urticaria several reports suggest that mast cells and eosinophil could be over-activated by pregnancy-related factors such as progesterone and estrogens [64 , 65]. This suggests that mucosa associated-innate immune response cells should be affected by sex steroid hormones [66 , 67]. However, further investigation concerning the participation of these hormones in the modulation of mast cell, basophil and eosinophil activity at the intestinal mucosa is required. Progesterone effects may be mediated by its intracellular PR. Our data show that PR expression was down-regulated by progesterone treatment, which denotes a classical feed-back regulation, previously described in several tissues as a regulatory mechanism of progesterone actions. However, to assess this point is necessary the use of anti-progestins with capacity to competitively bind to PR isoforms in hamsters [68 , 69]. Even though Th1-type cytokines activate neutrophils and macrophages in vitro resulting in parasitocidal activity mediated by nitric oxide [39 - 41] experiments in vivo have shown that neutrophils and macrophages are not capable of killing taenias. Several reports have described the ability of sex hormones to influence all cellular types of the innate and adaptive immune systems, thereby modifying a multitude of immunological functions [44 , 45]. It has been reported that in the late phase of T. IL-2 seems to be the major cytokine responsible for protection, whereas Th2-cytokines seem to be associated with susceptibility [46 , 49 , 50]. Our study sampled a broad profile of the cytokines with ability of influencing the course of infection in hamsters. At protein levels, semiquantitative immunofluorescence analysis from duodenum tissue samples suggested that the treatment with progesterone resulted in low levels of Th2-cytokines, accompanied by polarization of the cellular response toward a Th1-type, which has been related with parasite elimination [46 , 49 , 50]. This apparently controversial result can be explained since gene products are susceptible of post-transcriptional regulation mechanisms, as it is well known. Such mechanisms guarantee a balanced response at protein and cellular levels. Particularly, IL could be overproduced in order to diminish exacerbation of the inflammatory response at the duodenal mucosa, which besides eliminating taenias, could result in serious detriment for the host. Thus, the protective effect of the Th1-immune profile observed in progesterone-treated hamsters supports the notion that a strong Th1 response is associated with parasite elimination. Concomitantly, elevation of regulatory cytokines could be involved in preventing inflammation-related injury at the duodenal mucosa of the host. Progesterone treatment could also have a direct effect on the parasite. In this regard, T. In other parasites, specific hormone receptors have been shown to regulate the expression of diverse proteins [52 , 53]. Our preliminary data indicate that a non-classic receptor for progesterone is present in the cysticerci of T. Although the hamster model used here possibly does not reflect exactly all aspects of human taeniosis, a set of interactions are established between the parasite, the immune system and the endocrine system, which define the outcome of

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

the infection caused by *T.* Evidence presented here shows that progesterone treatment in hamsters reduces establishment and development of *T.* It is important to say that the experimental proof exposed in this work does not only concern to intestinal parasite infections, but also to other highly prevalent human gastrointestinal disorders where hormones seems to play a decisive role [70 - 80] such as irritable bowel syndrome IBS characterized by recurrent abdominal pain, bloating and constipation which is one of the most frequent chronic pelvic pain around the world [70 , 71]. Concomitantly, several clinical trials suggest that the use of medroxyprogesterone acetate a progesterone analogue exerts benefits for IBS treatment [71]. Additionally, Freedman and coworkers showed that higher levels of progesterone in mature women subjected to hormonal replacement therapy correlate with low incidence of esophagus and stomach adenocarcinomas, which may partially explain the higher prevalence rates of gastrointestinal tract cancers in men than in women [76]. Moreover, high-turnover type osteoporosis a common complication in patients with primary biliary cirrhosis is significantly attenuated by hormonal replacement therapy without increasing risk of cholestasis [78]. Progesterone also has beneficial effects on *Helicobacter pylori*-associated gastritis in female ovariectomized gerbils, which showed a significant reduction in gastrin-positive cells [79]. The evidence presented in our work illustrates the importance of immunoendocrine interactions in an immunocompetent host. It strongly suggests an important role for sex steroids, particularly progesterone, in the cytokine network. The complexity of the immunoendocrine interactions suggests that all physiological factors i. Taking into consideration the feasible role of progesterone on mucosal immunity, present results may open an interesting perspective in the possible use of sex steroid hormone analogues as adjuvants for anti-parasite vaccination, with strong immune actions but minimal endocrine effects, which could contribute to design different strategies for control intestinal helminth infections such as taeniosis by *T.*

Conflict of Interests The authors have declared that no conflict of interest exists.

Sociocultural factors and local customs related to taeniasis in east Asia. *Kaohsiung J Med Sci.* Growing frequency of neurocysticercosis in Madrid Spain. Protection of pigs with cysticercosis from further infections after treatment with oxfendazole. *Am J Trop Med Hyg.* Population-based survey of taeniasis along the United States-Mexico border. *Ann Trop Med Parasitol.* Renewed hope for a vaccine against the intestinal adult *Taenia solium*. *N Engl J Med.* Seroprevalence of cysticercosis in an Orthodox Jewish community. Host gender in parasitic infections of mammals: Parasite regulation by host hormones: Bottasso O, Morales-Montor J. Neuroimmunomodulation during infectious diseases: Sex-associated hormones and immunity to protozoan parasites. Hormonal and immunological mechanisms mediating sex differences in parasite infection. Castration and pregnancy of rural pigs significantly increase the prevalence of naturally acquired *Taenia solium* cysticercosis. Impact of naturally acquired *Taenia solium* cysticercosis on the hormonal levels of free ranging boars. Teniosis and cysticercosis due to *T.* Relationship between the clinical heterogeneity of neurocysticercosis and the immune-inflammatory profiles. Sex hormone changes induced by the parasite lead to feminization of the male host in murine *Taenia crassiceps* cysticercosis. *J Steroid Biochem Mol Biol.* Immunological mediation of gonadal effects on experimental murine cysticercosis caused by *Taenia crassiceps* metacestodes. Gonadectomy and progesterone treatment induce protection in murine cysticercosis. Influence of female gonadal hormones on the parasitemia of female *Calomys callosus* infected with the "Y" strain of *Trypanosoma cruzi*. Antischistosomal action of atorvastatin alone and concurrently with medroxyprogesterone acetate on *Schistosoma haematobium* harboured in hamster: Immunoparasitological evaluation of *Trichinella spiralis* infection during human pregnancy: New target cells of the immunomodulatory effects of progesterone. Hormones, immune response, and pregnancy in healthy women and SLE patients. Asymmetric antibodies AAb in the female reproductive tract. CD83 monocyte-derived dendritic cells are present in human decidua and progesterone induces their differentiation in vitro. *Am J Reprod Immunol.* Role of steroid hormones in *Trichinella spiralis* infection among voles. Immunoendocrine interactions during chronic cysticercosis determine male mouse feminization: Influence of melatonin therapy and orchietomy on T cell subsets in male Wistar rats infected with *Trypanosoma cruzi*. Differential expression of AP-1 transcription factor genes *c-fos* and *c-jun* in the helminth parasites *Taenia crassiceps* and

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

Taenia solium. Progesterone induces scolex evagination of the human parasite Taenia solium: Progesterone receptor isoforms are differentially regulated by sex steroids in the rat forebrain. Progesterone inhibits mature rat dendritic cells in a receptor-mediated fashion. The role of glucocorticoids and progestins in inflammatory, autoimmune, and infectious disease. Szekeres-Bartho J, Polgar B. The Double Edged Sword: Immunoendocrine mechanisms associated with resistance or susceptibility to parasitic diseases during pregnancy. Standardization of an experimental model of human taeniosis for oral vaccination. Annu Rev Genomics Hum Genet. Progress in the development of vaccines against helminthes. Helminthic diseases in the abdomen: Effective protection against experimental Taenia solium tapeworm infection in hamsters by primo-infection and by vaccination with recombinant or synthetic heterologous antigens. The development of effective vaccine adjuvants employing natural regulators of T-cell lymphokine production in vivo. Ann NY Acad Sci. Dehydroepiandrosterone DHEA treatment reverses the impaired immune response of old mice to influenza vaccination from influenza infection. The use of oral dehydroepiandrosterone sulfate as an adjuvant in tetanus and influenza vaccination of the elderly. Oral administration of dehydroepiandrosterone-sulfate DHEAS increases in vitro lymphocyte function and improves in vivo response of pigs to immunization against keyhole limpet hemocyanin KLH and ovalbumin. Sex hormones and the immune response in humans. Stringer E, Antonsen E. Hormonal contraception and HIV disease progression. Epithelial cells in the female reproductive tract:

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

4: Progesterone Induces Mucosal Immunity in a Rodent Model of Human Taeniosis by *Taenia solium* - CO

Avila G, Aguilar L, Romero-Valdovinos M, Garcia-Vazquez F, Flisser A. Cytokine response in the intestinal mucosa of hamsters infected with *Taenia solium*. *Annals of the New York Academy of Sciences*. ;

Marcela Maravilla *Taenia solium*: The human tapeworm carrier is the main risk factor for acquiring neurocysticercosis. Since the parasite lodges only in the human intestine, experimental models of *Taenia solium* taeniosis have been explored. Macaques, pigs, dogs, cats and rabbits are unsuccessful hosts even in immunodepressed status. By contrast, rodents are adequate hosts since tapeworms with mature, pregravid and, in some cases, gravid proglottids develop after infection. In this review, information that has been generated with experimental models of taeniosis due to *T.* Initially, the use of the model for immunodiagnosis of human taeniosis and evaluation of intervention measures is summarized. Finally, evaluation of protection induced against the development of tapeworms by recombinant *T.* Free-roaming pigs that live where open latrines or Neurocysticercosis, the disease caused by the larval airborne faecalism exist, ingest human faeces and, if stage of the cestode *Taenia solium*, is an important contaminated with gravid proglottids or free eggs, cause of morbidity, and in some cases, mortality cysticerci develop in their muscles and brain. The Fleury et al. Human beings are the only natural hosts et al. Humans acquire the intestinal infection for the adult stage of *T.* Tapeworm carriers in the develops in the small intestine ; the last proglottids, household are the main risk factor for acquiring which are gravid, are shed with faeces. Humoral and cellular immune re- community-based studies. One such study per- sponses can be studied in the intestinal mucosa, formed in Mexico allowed detecting changes in the mesenteric lymph nodes, spleen, serum, saliva and rate of human taeniosis before and after an edu- faeces of experimental hosts. Vaccines against cational campaign directed especially towards gen- human taeniosis can be evaluated. Immune regu- erating changes in KAP knowledge, attitudes and lation by helminths in the intestinal mucosa is now practices regarding cysticercosis and taeniosis. The an emerging area of immunological research. Based on the description given by Anne et al. Faeces were collected from infected and control Garcia et al. When mass drug treatment hamsters and the intestines examined post-mortem against the adult tapeworm was administered in for the presence of worms. Only one cat and one dog had tivity is independent of the presence or number of incipient tapeworms that remained for a few days eggs in faeces and the assay becomes negative within in the small intestine Varma and Ahluwalia, ; a week of treatment Allan et al. These conclusions indicate that CpAg immunosuppression, was experimentally infected ELISA is useful for diagnosis of human tapeworm and a gravid tapeworm was recovered Cadigan et al. Photographic images showing histological characteristics of the structures that constitute a tapeworm: Longer parasites develop pre-gravid pro- Cricetidae, Heteromyidae and Chinchillidae are glottids, while in worms less than 2 cm long, only susceptible as experimental models. Morphological characteristics of the scolex of When mature seg- Electron microscopy of attached parasites to ments were present, many reproductive structures the intestinal mucosa of hamsters showed that the could be seen, such as the cirrus Fig. Regarding adult infections of *T.* Flisser and others Fig. The ejected cirrus in a mature proglottid recovered from a sample of sieved hamster faeces can be seen slightly curved towards the vagina. Establishment with hydrocortisone allowed recovery of tapeworms of tapeworms was associated with the concentration Pathak and Gaur, ; Varma and Ahluwalia, of methyl prednisolone acetate MPA. A similar picture was observed 25 was 10 mm compared to 1 to 2 mm in controls. Im- The worms recovered from hamsters given predni- mature worms were obtained from non-depressed solone had developed to sexual maturity but were gerbils, while pre-gravid ones were recovered from unable to produce eggs. The development of worms gerbils which received the higher dose of MPA was best seen in hamsters treated with mepramine Maravilla et al. Golden hamsters are more maleate or prednisolone Pathak and Gaur, When hosts are not methotrexate MTX and mycophenolate mofetil immunodepressed infections last up to 46 days in MMF , non-steroid drugs widely used in auto- hamsters and up to 25 days in gerbils, and worms immunity,

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

transplant and oncology medicine, were measure up to 40 cm in hamsters but only 1â€”2 cm in also assayed. No tapeworms were found at necropsy gerbils Avila et al. These factors were analyzed in the ; Avila et al. The higher doses of MPA, gerbils infected with T. Small fraction of a chinchilla intestine after necropsy showing several attached tapeworms, with well developed strobila. CpAg to steroid or other potentially damaging treatments. Higher doses inhibited post-infection and tapeworms were recovered at evagination of cysticerci, while lower doses only necropsy Fig. Gamma irradiation of food is considered Avila et al. Therefore the experimental model of taeniosis due Chinchillas Chinchilla laniger are currently to T. Gravid tapeworms were recovered from providing eggs and adult parasites to be used in dif- MPA-treated chinchillas and infective eggs were ferent types of experiments, including vaccine trials. Three experiments were performed, order to improve this model since wasting due to each with 11 chinchillas that were immunodepressed steroid treatment was evident see above. Macrophages, epithelioid compared to 2. Both hamsters and gerbils were studied Spady et al. The normal shape of the bile salt synthesis, composition of the bile salt pool, mucosa was lost in infected animals; oedema and various aspects of lipoprotein transport, and re- loss of the villous structure, stunted and deformed sponse to dietary and pharmacologic interventions. The highest increase in these cells was seen at 13 dpi in gerbils but until 18 dpi in hamsters. All infected hamsters in both time that the peak of mast cells 19 dpi. On the other hand, local mast cells are main players in the expulsion of para- IgG production faecal antibodies was successfully sites Avila et al. The number of positive animals et al. Results indicate that T. The mucosa and the tapeworm show intense staining of mucin and, in the mucosa, goblet cells are seen as darker dots. In later stages, D, E oncosphere cells show diminished expression of the protein. The reaction was evident as dark precipitates. Th1 cytokines were in host-parasite relationships Michalak et al. Taenia solium calreticulin A. Expression was demonstrated by immuno- CONCLUSIONS Calreticulin interacts with the immune system of the host ; anti-CRT antibodies have been detected in The use of animal models of taeniosis has been patients with infections caused by trypanosomes, critical for understanding the host-parasite relation- schistosomes and Onchocerca Rokeach et al. Development of Marcelain et al. Calreticulin is over-expressed in worms assays. After nearly 40 years of use of golden ham- during chronic intestinal parasitic diseases Morgan sters and, more recently, gerbils and chinchillas as et al. This novel knowledge on the host-parasite relationship. Only few examples of vaccination trials against All protocols were submitted to the Ethics and adult tapeworms have been published. Studies were commenced only suppression of egg production Herd et al. In a after approval. Immunodiagnosis of taeniasis by coproantigen detection. Furthermore, tapeworms found Annals in Tropical Medicine and Parasitology 85, in immunized hosts were smaller and were attached â€” Journal of Parasitology 86, â€” Immunodiagnostic tools for taeniosis. In Tropica 87, 87â€” American Society metacestodo de Taenia solium. The development of the tapeworm Parasitology Today 4, â€” Parasite Nitzsch, and D. Jr, and de Aluja, A. Apoptosis induced by Stadecker, M. Protective gamma irradiation of Taenia solium metacestodes. Nature Parasitology Research 90, â€” Reviews in Immunology 7, â€” Animal Biodiversity and Emerging Peru. Annals of the New York Academy of Sciences â€” Kinetics of Taenia solium antibodies and antigens Lack of postmortem digestion of tapeworms in golden in experimental taeniosis. Parasitology Research 89, hamsters experimentally infected with Taenia solium. Veterinary Parasitology , â€” The golden hamster P. Laboratory animal models for Mesocricetus auratus Watherhouse as potential human Taenia solium. In Ethics, Animals and H. Blackwell Science, Great Craig, P. Journal of Guillou, F. Mongolian gerbil Meriones unguiculatus. Acta Tropica Molecular Biochemistry and Parasitology , 45â€” Synthetic peptide vaccine against Journal of Parasitology 92, â€” Taenia solium pig cysticercosis: Vaccine 20, Demellawy, M. Flisser and others Kamiya, M. Complete life Petavy, A.

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

5: Laura Aguilar - www.enganchecubano.com

The inflammatory response in gerbils and hamsters harbouring experimental infections with Taenia solium adult parasites as well as worm burden and duration of infections were examined.

Sorry, we are unable to provide the full text but you may find it at the following location s: Suggested articles Citations Am J Trop Med Hyg. Antischistosomal action of atorvastatin alone and concurrently with medroxyprogesterone acetate on Schistosoma haematobium harboured in hamster: Asymmetric antibodies AAb in the female reproductive tract. Castration and pregnancy of rural pigs significantly increase the prevalence of naturally acquired Taenia solium cysticercosis. CD83 monocyte-derived dendritic cells are present in human decidua and progesterone induces their differentiation in vitro. Am J Reprod Immunol. Chronic pelvic pain in women. Cytokine response in the intestinal mucosa of hamsters infected with Taenia solium. Dehydroepiandrosterone DHEA treatment reverses the impaired immune response of old mice to influenza vaccination from influenza infection. Differential expression of AP-1 transcription factor genes c-fos and c-jun in the helminth parasites Taenia crassiceps and Taenia solium. Do fluctuations in ovarian hormones affect gastrointestinal symptoms in women with irritable bowel syndrome? Effective protection against experimental Taenia solium tapeworm infection in hamsters by primo-infection and by vaccination with recombinant or synthetic heterologous antigens. Effects of estradiol and progesterone on gastric mucosal response to early Helicobacter pylori infection in female gerbils. Effects of pregnancy in rats on cysteamine-induced peptic ulcers: Effects of progesterone on intestinal inflammatory response, mucosa structure alterations, and apoptosis following traumatic brain injury in male rats. Epithelial cells in the female reproductive tract: Estradiol activates mast cells via a non-genomic estrogen receptor-alpha and calcium influx. Estrogen-progestogen therapy for low bone mineral density in primary biliary cirrhosis. Gender differences in irritable bowel syndrome. Gonadectomy and progesterone treatment induce protection in murine cysticercosis. Growing frequency of neurocysticercosis in Helminthic diseases in the abdomen: Hormonal and immunological mechanisms mediating sex differences in parasite infection. Hormonal contraception and HIV disease progression. Hormones, immune response, and pregnancy in healthy women and SLE patients. Host gender in parasitic infections of mammals: Immunoendocrine interactions during chronic cysticercosis determine male mouse feminization: Immunoendocrine mechanisms associated with resistance or susceptibility to parasitic diseases during pregnancy. Immunological mediation of gonadal effects on experimental murine cysticercosis caused by Taenia crassiceps metacestodes. Immunoparasitological evaluation of Trichinella spiralis infection during human pregnancy: Impact of naturally acquired Taenia solium cysticercosis on the hormonal levels of free ranging boars. Influence of melatonin therapy and orchietomy on T cell subsets in male Wistar rats infected with Trypanosoma cruzi. Interactions of the female hormonal environment, susceptibility to viral infections, and disease progression. New target cells of the immunomodulatory effects of progesterone. Neuroimmunomodulation during infectious diseases: Oestradiol enhances in vitro the histamine release induced by embryonic histamine-releasing factor EHRF from uterine mast cells. Oral administration of dehydroepiandrosterone-sulfate DHEAS increases in vitro lymphocyte function and improves in vivo response of pigs to immunization against keyhole limpet hemocyanin KLH and ovalbumin. Parasite regulation by host hormones: The Double Edged Sword: Population-based survey of taeniasis along the United States-Mexico border. Ann Trop Med Parasitol. Progesterone induces scolex evagination of the human parasite Taenia solium: Progesterone inhibits mature rat dendritic cells in a receptor-mediated fashion. Progesterone receptor isoforms are differentially regulated by sex steroids in the rat forebrain. Progesterone-responsive urticaria and eosinophilia. Progress in the development of vaccines against helminthes. Protection of pigs with cysticercosis from further infections after treatment with oxfendazole. Relationship between the clinical heterogeneity of neurocysticercosis and the immune-inflammatory profiles. Renewed hope for a vaccine against the intestinal adult Taenia solium. Role of steroid hormones in Trichinella

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

spiralis infection among voles. RU is not an antiprogestin in the hamster. *Annu Rev Genomics Hum Genet.* Seroprevalence of cysticercosis in an Orthodox Jewish community. Sex hormone changes induced by the parasite lead to feminization of the male host in murine *Taenia crassiceps* cysticercosis. *J Steroid Biochem Mol Biol.* Sex hormones and the immune response in humans. Sex hormones and urticaria. Sex-associated hormones and immunity to protozoan parasites. Sociocultural factors and local customs related to taeniasis in east Asia. *Kaohsiung J Med Sci.* Standardization of an experimental model of human taeniosis for oral vaccination. Teniosis and cysticercosis due to *T.* The development of effective vaccine adjuvants employing natural regulators of T-cell lymphokine production in vivo. *Ann NY Acad Sci.* The role of glucocorticoids and progestins in inflammatory, autoimmune, and infectious disease. The use of oral dehydroepiandrosterone sulfate as an adjuvant in tetanus and influenza vaccination of the elderly. Treatment of chronic bleeding from gastric antral vascular ectasia GAVE with estrogen-progesterone in cirrhotic patients:

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

6: Laura Aguilar | University of Aberdeen - www.enganchecubano.com

BioMed Research International and A. Flisser, "Cytokine response in the intestinal mucosa of hamsters infected with Taenia solium," Annals of the New York.

Find articles by Sonia Leon-Cabrera J. Find articles by J. Carrero Jorge Morales-Montor 3. Find articles by Jorge Morales-Montor 1. Telephone 55 , Fax 55 The authors have declared that no conflict of interest exists. This is an open-access article distributed under the terms of the Creative Commons License <http://creativecommons.org/licenses/by/4.0/>: reproduction is permitted for personal, noncommercial use, provided that the article is in whole, unmodified, and properly cited. This article has been cited by other articles in PMC. The *Taenia solium* tapeworm carrier is the main risk factor in the transmission of both human neurocysticercosis and porcine cysticercosis. Sex steroids play an important role during T. Thus, we evaluated the effect of progesterone administration upon the experimental taeniosis in golden hamsters *Mesocricetus auratus*. Intact female adult hamsters were randomly divided into 3 groups: Animals were treated every other day during 4 weeks. After 2 weeks of treatment, all hamsters were orally infected with 4 viable T. These results support that progesterone protects hamsters from the T. *Taenia solium*, cysticercosis, sex hormones, progesterone, inflammation. Introduction *Taenia solium* is a cestode parasite that affects both human and pigs 1 , 2. Typically described as a health problem in developing countries 3 , 4 , T. The intermediate stage of T. The intestinal adult form of the parasite is receiving rising interest since it is considered as the main risk factor in the propagation of the disease for both organisms 9 - The fact that the T. Then, more experimental and clinical research strategies should be directed to control the T. Sex steroid hormones have an important role during parasite infections 14 - 16 , either by modulating host immune response 17 - 18 or having direct effects upon parasites Interestingly, pregnancy in female pigs and castration in male boars increase the prevalence of naturally acquired cysticercosis This evidence leads us to assume that sex hormones can be either permissive or restrictive factors in the establishment of the intermediate stage of T. In humans, intestinal taeniosis is more frequent in women than in men 21 - Similarly, the inflammatory response associated to the presence of brain located-cysticerci, exhibits a dimorphic pattern, being more severe in women than in men, presumably due to the higher number of eosinophils, and other proinflammatory effector cells, as well as IL-5 and IL-6 levels, in women cerebral spinal fluid In the same sense, female mice are more susceptible than males to experimental murine cysticercosis by T. Such difference in susceptibility is abolished by gonadectomy of both genders In a similar manner, *Schistosoma haematobium*-infected hamsters show a decrease in the number of recovered worms and egg load in response to the administration of medroxyprogesterone acetate, a progesterone analogue indicated as human contraceptive Pregnancy seems to have a protective role against *Trichinella spiralis* infection, attributed to the toxicity properties of progesterone against helminth As it can be seen, progesterone is strongly involved in the protection or susceptibility to several parasite infections, as it could be the case for the T. Complementary, progesterone also has several immunomodulatory actions For instance, it is directly involved in the immune tolerance against fetus presumably due to its influence on the activity of T cells and natural killer cells during pregnancy Regarding to the B and T cells function, progesterone induces production of IgG class 1 antibodies and promotes the increase in the TCR gamma delta positive cell population This hormone is able to stimulate the differentiation of dendritic cells from healthy human-derived peripheral blood mononuclear cells which could be involved in the Th2-immune response polarization during pregnancy Then, besides the role of progesterone in parasitic diseases, it is clear that this hormone has the ability to influence the immune system by affecting cellular differentiation, cytokines and antibodies production, and effector cells activity 31 - Taking into consideration that progesterone can specifically modulate the immune response 35 - 38 and directly affect both cysticerci from T. Based on the evidence presented above, and for being considered one of the most important circulating hormones during female pregnancy with well described immunostimulator actions 41 - 45 , here we evaluated the effect of

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

progesterone upon the experimental taeniosis in golden hamsters *Mesocricetus auratus*, having special emphasis in its influence upon the host mucosal immune response at bowel level. Pigs sacrifice to obtain parasites was performed under sodium pentobarbital anesthesia, and all efforts were made to minimize suffering. The fibrous capsule surrounding each parasite was carefully separated under a dissection microscope. Each single dose of progesterone was diluted in 0. Hormone and vehicle administration was carried out each other day during four weeks, in order to maintain the same hormonal serum concentration for the entirely time of the experiment. Our results were obtained from two independent experiments performed in similar conditions. Animals were fed with Purine Diet Purine, St. Louis, MO and water ad libitum during all the experiment. Oral infection experiments Two weeks after the beginning of progesterone or vehicle administration, treated and untreated animals were orally infected with four viable T. All animals were euthanized 15 days post infection, using a CO₂-saturated chamber. Under a stereoscopic microscope, the lumen of all small intestines was carefully exposed by making a longitudinal cut using sterile dissection scissors. Then, duodenum-anchored parasites were counted and measured with a calibrator. Blood samples were individually collected from all animal groups for posterior serum analysis. Ileum attachment zones where T. Immediately after necropsy, spleen weight was individually recorded. Cell culture and lymphoid proliferation Total leukocytes and red blood cells were extracted from spleen and mesenteric lymph nodes of all animal groups. The nm lecture coefficient was employed to assess proliferation index. Cytokines and progesterone receptor expression Spleen and anchored tapeworms-related duodenum samples were placed in Trizol reagent Invitrogen, Carlsbad, California. Total RNA extraction was as follows: RNA concentration was determined by absorbance at nm and its purity was verified after electrophoresis on 1. Table 1 Primers used for amplification of hamster-specific genes. Primer sequence as well expected molecular weight of the PCR product is shown.

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

7: Tamoxifen Treatment in Hamsters Induces Protection during Taeniosis by Taenia solium

For this purpose hamsters were infected per os with 8 T. solium cysticerci, necropsies were performed at different days post-infection. One cm biopsies of the small intestine were taken from the area surrounding the scolex of all tapeworms found, fixed in PBS-paraformaldehyde and processed by histological techniques; 3µm sections were obtained.

Find articles by Galileo Escobedo M. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. This article has been cited by other articles in PMC. Abstract Human neurocysticercosis by Taenia solium is considered an emergent severe brain disorder in developing and developed countries. Discovery of new antiparasitic drugs has been recently aimed to restrain differentiation and establishment of the T. Tamoxifen is an antiestrogenic drug with cysticidal action on Taenia crassiceps, a close relative of T. Thus, we evaluated the effect of tamoxifen on the in vitro evagination and the in vivo establishment of T. In vitro, tamoxifen inhibited evagination of T. These results demonstrate that tamoxifen exhibits a strong cysticidal and antitaeniasic effect on T. Introduction Human neurocysticercosis by Taenia solium is considered a serious brain disorder in developing countries [1], with an alarmingly increased number of new cases in developed industrialized nations [2]. Furthermore, it has been estimated that around 0. The parasite life cycle takes place in both pigs and humans [4]. In this way, pigs develop the intermediate larvae stage of T. After a subject ingests undercooked contaminated pork meat, the T. Once this tapeworm has developed gravid mature proglottids, thousands of eggs are released with the stools into the environment, where they will be capable to infect free-ranging boars, maintaining the parasite life cycle [1 , 5]. In parallel, neurocysticercosis can be acquired by humans once they have been accidentally exposed to stools containing T. For this reason, discovery of new anti-taeniosic drugs should be aimed to restrain differentiation, establishment, and egg production of the T. Tamoxifen is a competitive antagonist of the estrogen receptor that has been widely used for treating breast cancer in premenopausal women and gynaecomastia in men receiving hormonal therapy for prostatic carcinoma [8 , 9]. Interestingly, the use of this antiestrogenic drug has also proved to be effective against several protozoan parasites, including Leishmania major, L. Nevertheless, the tamoxifen effect upon helminth cestode parasites has been exclusively studied for the case of Taenia crassiceps, the causal agent of experimental murine cysticercosis [14]. Actually, tamoxifen inhibits T. Thus, we evaluated the effect of tamoxifen on Taenia solium, focusing on several important aspects of the adult tapeworm stage, including differentiation from cysticercus to worm on in vitro cultures, and establishment of the intestinal tapeworm using the hamster model for experimental taeniosis in vivo. This paper could contribute to the search and design of novel therapeutic agents for the control of cysticercosis and taeniosis in livestock and humans. Materials and Methods 2. Pigs sacrifice to obtain parasites was performed under sodium pentobarbital anesthesia, and all efforts were made in order to minimize suffering. The fibrous capsule surrounding each cysticercus was carefully separated under a dissection microscope. Baker to the desired stock concentration. Stock solutions were sterilized by passage through a 0. For concentration-response curves, the experimental design was as follows: Control parasites were incubated either in presence of 0. For time-response curves, cysticerci were incubated in presence of increasing doses of tamoxifen 0. Both concentration and time-response experiments were daily inspected for scolex evagination and worm growth using an inverted microscope at 4 and 10X magnification Olympus, MO21, Tokyo. Worm growth was considered as the millimeter sum of scolex, neck, and strobila, as we previously reported [20]. Each single dose of tamoxifen was diluted in saline solution 0. Two different groups of control animals were used in all of our experiments, as follows: Tamoxifen and vehicle administration was carried out each other day for 4 weeks, in order to maintain a constant serum concentration for the entire time of the experiment. Animals were fed with Purine Diet Purine, St. Louis, MO and water ad libitum. Oral Infection Experiments Two weeks after the beginning of the drug administration, tamoxifen, vehicle, and control animals were orally

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

infected with four viable T. All of the animals were euthanized 15 days postinfection, using a CO₂-saturated chamber. Under a stereoscopic microscope, the lumen of the small intestine was carefully exposed by making a longitudinal cut using a sterile dissection scissor. Duodenum-anchored parasites were then counted and measured with a calibrator. Cell Culture and Lymphoid Proliferation Total leukocytes and red blood cells were individually extracted from the mesenteric lymph nodes of all of the animals. The λ nm lecture coefficient was employed to assess the proliferation index. Cytokine Expression Spleen and scolex-associated duodenal tissue were placed in Trizol reagent Invitrogen, Carlsbad, California. Total RNA extraction was as follows: The aqueous phase was recovered after 15 min of centrifugation at rpm, and treated with a same volume of isopropyl alcohol for RNA precipitation. RNA concentration was determined by absorbance at nm, and its purity was verified after electrophoresis on 1. The relative expression rate of each amplified gene was obtained by optical density analysis OD , using the 18S-ribosomal RNA as constitutive control of expression. Table 1 Primers used for amplification of hamster-specific genes. Primer sequence as well as molecular weight expected of the PCR product is shown.

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

8: IMMUNOLOGY OF TAENIA SOLIUM TAENIASIS AND HUMAN CYSTICERCOSIS - Europe PMC Article

The establishment of Taenia solium adult parasite in the human intestine causes taeniosis. Importantly, the immunological mechanisms occurring at the interface between the parasite and its host are not fully known.

Introduction Intestinal helminth infections still represent a public health problem in many developing tropical and subtropical countries affecting the health of human beings and of livestock [1 , 2]. In response to different antigens, these cells differentiate in four types of T-helper cells Th1, Th2, Th17, and regulatory T cells. Helminths and their antigens induce Th2 immune responses, and protection against these parasites seems to be dependent on this polarization. Moreover, basophils and mast cells are activated by IgE-immune complexes through crosslinked-high-affinity Fc receptors FcRs for IgE located on the cell surface. Then, these cells are able to degranulate and release cytokines, chemokines, proteases, serotonin, histamine, and heparin, resulting in smooth muscle hypercontractibility, increased permeability, and inflammatory cell recruitment that, accompanied by mucus production, will facilitate clearance of parasites Figure 1. Figure 1 Components of type 2 immune response effective against gastrointestinal GI helminth parasites. IgE immune complexes activate basophils and mast cells by crosslinking of FcR. Activated mast cells and basophils secrete soluble mediators inducing changes in smooth muscle contractility, peristalsis, and intestinal permeability increase. IL-4 also induces goblet cell proliferation and mucus production. All of these elements induce a hostile environment for the parasite, provoking their expulsion or their reduction in size and fecundity. Basic aspects about activation of Th1- and Th2-type immune responses are well characterized. Nevertheless, the immunological mechanisms leading towards induction of Th2 immune responses remain to be elucidated. Early production of IL-4 is essential for Th2 differentiation [3]. However, DCs are not able to produce IL-4. Recently, it has been documented that basophils are involved in development and amplification of type 2 immune responses during helminth infections, because they are capable of producing and secreting IL-4 in response to helminth antigens and by crosslinking of antigen-specific IgE complexes. Additionally, recent data have revealed a function of basophils not only in the initiation and maintenance of type 2 responses, but also in protective immunity and memory responses. Nonetheless, the potential enrolment of basophils in the initiation of Th2 immunity is under study, and results obtained from different research groups have become controversial, which highlights the importance of investigating the interactions between helminths and this cell type. The main goal of this paper is to provide an overview of recent findings in this regard. However, Th2-associated DCs signals have not been identified yet. In spite of the fact that DC express MHC-class-II and costimulatory molecules, very little is known about how DCs could sense Th2-type antigens, the nature of DCs subsets, whether they are sufficient to initiate Th2 responses, and if it is necessary establishing cooperation with innate immune cells. These cells mature in the bone-marrow before entering the blood stream, express FcRs and are capable of secreting Th2 cytokines such as IL-4 and thymic stromal lymphoprotein TSLP , both important molecules for Th2 induction [16 , 17]. Basophils can be activated through an IgE-dependent or IgE-independent process secreting, in consequence, important amounts of IL-4 [

CYTOKINE RESPONSE IN THE INTESTINAL MUCOSA OF HAMSTERS INFECTED WITH TAENIA SOLIUM pdf

For health and beauty Witchcraft and gender in early modern society Language attitudes and choice in the Scottish Reformation Marina Dossena Cromwell and the paradoxes of Puritanism J. F. H. New Star Trek Sarek (Star Trek Status of Indian women. You Win Some. Lose/ You lost the Death Man Game but then decided you still wanted to live. Collage from seeds, leaves, and flowers Towards more effective monetary policy Hello, Mallory (The Baby-Sitters Club #14) Discovering a Sense of Proportion 33 Week 3 Folk revival connection : the musicians A Jesuit apologia : appellant abuse Our god chris tomlin piano sheet music My eldest brother The bane chronicles books Lincoln addresses and letters Relativistic quantum mechanics and introduction to quantum field theory Perfect chemistry book Answers to text exercises Peroxiredoxin systems of protozoal parasites Marcel Deponte, Stefan Rahlfs and Katja Becker Star wars rpg dawn of rebellion Statistics for Business and Economics, Revised (with Student CD-ROM) A Petlove Guide to Finches Komatsu forklift model fg25st-12 manual Tafsir jalalain bangla Internal auditing assurance and consulting services 2nd edition Employee benefits Grannys Lucky Touch 95. Soviet Russian Navy, Insignia of Rank on Cuffs and Shoulders 429 The language of creation Reel 136. Los Angeles County, Los Angeles City (part). Honor card other poems Selected problems and questions in strength of materials Rutherford and Son Bringing a dream to life Confronting youth crime Rural crafts in Scotland Classifying reactions to wrongdoing