Immunotherapy as a science of treatment can be categorized into two very broad ca...

Health & Medicine, Cancer

Introduction

Immunotherapy is a process through which diseases related to or rather affecting the immune system are treated by simply ensuring the capabilities of the immune system are improved.

Such is possible through various ways but the most common method of enhancing the immune system and ensuring its effective is through vaccination. This can also be made possible by eliminating or alternatively controlling some immune responses as evident when dealing with allergy issues. According to Edwin Smith Papyrus, treatment of most complex diseases was effected through surgery as it was considered the most effective method of treatment. This was mostly as regarded cancerous diseases that led to the development of tumours.

Such an indication is not meant to surges that the traditional way of cutting tumours using knives stopped; however, it serves to appreciate this treatment method for its effectiveness, though after undergoing some bit of modernization. Radiation therapy in the treatment of tumours is not a recent technology either, this kind of treatment mechanism was introduced back in the 19th century in the year 1890 though it was until recently that it was established as a major means to the treatment of cancer cases. It is clear that not all the radiation therapies are applicable in the treatment of cancer; rather this is specific to chemotherapy that was introduced later after other methods in the 20th century. A major case where chemotherapy was applied

in treating cancer and turned out effective was the treatment of leukaemia and it was used as a trial (Zabriskie 2009).

After the case mentioned above, more clinical trials on the effectiveness of another emerging therapy, immunotherapy were carried out on cancer victims, organ transplantation and various allergy cases. Positive discoveries were made that gave the medical practitioners much confidence to continue using immunotherapy as a treatment mechanism.

A practical application of the immunotherapy treatment scheme is evident with a widely known surgeon called William B. Coley. This widely learned and respected surgeon carried out a clinical experiment in bid to evaluate how cancer treatment could be made possible by influencing the immune system. He practically did this by delivering some cancer causing bacteria he had killed and prepared as a vaccine to cancer patients. He then made observations to see whether the tumours they had were reducing, as evidence to the effectiveness of the vaccine. It was true that some decrease in tumours was observed in the victims, but not to all. This probed the need for further research in this area, and early in the 20th century new mechanisms were proposed. The newly proposed cancer treatment schemes were somehow complex relative to the use of vaccines; these involved a study of the T cells and an understanding of the whole antigen representation technology. Such knowledge called for a need to know more about the growth of the T cells which could then be stopped and a discovery of the dendrite cells also key to the treatment of cancer. However, with civilization and technology taking over the traditional means of doing

research, there has been experienced a major change in the treatment of cancer. Of late, it’s the cytokines that are in application in cancer treatment as more research is underway (Zabriskie 2009).

Active immunity

Just as the name suggests, this type of immunity focuses at ensuring an immune response is experienced and hence making sure that antibodies are produced to end the process. Antibodies are some type of proteins found in the body cells and which are classified under a class known as globulins. All components or rather elements of class globulins have a four-chin structure that has some two identical heavy (H) chins and whose molecular weight is 25 kDa. In initiating an immune response, an antigen needs to be identified and this is done by a mechanism that is attributed to the lock and key means of operation. A practical example of such a happening is where a patient is injected with a vaccine that contains killed antigens that resemble the ones found in the tumour. Such an occurrence in the body system means there will be a response to remove the newly recognized antigens. The antibodies are, therefore, sensitized into reacting against the tumour, possibly killing its cells. Such a mechanism is used in curing so many diseases and has been proved effective. However, it should be noted that this mechanism is not yet understandable to many people, even to the medical practitioners themselves. Positively, however, more research on this is being conducted and there is hope that more discoveries will clear the air (Kindt, Goldsby & Osborne 2007).

Passive immunity

On the other hand is the passive immunity. This type of immune response is called passive since the body is either slow to initiating a response, or in some cases it completely does not initiate a response. This, therefore, calls for injection of antibodies into the body that will help in countering any unknown organisms that may be detected. A major advantage with the external antibodies is the speed with which they initiate an immune response in the body. However, unlike the natural antibodies that exist in the body, these antibodies have a very limited lifespan since they do not enjoy the benefits of internal antibody replacement. Their lifespan is between some days to weeks after which they are considered malfunctioning and their presence in the body is considered useless or rather less important. Passive immunity can be further sub-divided into natural and artificial. Natural passive immunity is possible in young babies for as long as they are breastfed by their mothers. It’s during breastfeeding that the antibodies are passed onto the babies from their mothers to help in the immune response.

This is so and very important in the surviving chances of babies since at this age they are not able to produce their own antibodies. Maybe to deviate a little, this is the major reason behind the importance of breastfeeding and why all mothers are advised to breastfeed their children until a given age, probably when they can produce their own antibodies. Such immunity is also possible during birth, where antibodies are transferred from the mother to the child through the placenta. Then there is the artificial passive immunity. This involves production of antibodies from an environment external to the body and then injecting them into the body once they are ready to. These

can be produced from human beings or from some animals. A real life situation where such kind of immunity has been put into full use is to do with the treatment of diphtheriaandtetanus, a condition that is popular for its curing using antibodies from horses. Currently, this kind of immunity is used when dealing with cases where victims have been affected by certain animals. It’s also most common in use with victims suffering from rubella and hepatitis. Some new mechanisms towards use of artificial passive immunity also require that the victims be injected with antibodies obtained from people immunized against such conditions. Research also reveals that the use of serum and or antiserum on the affected persons is also a possible treatment scheme (Coico, Sunshine & Benjamini 2009).

Immunotherapy in transplantation

There are some sets of genes in the chromosomes that contain the histocompatibility complex (MHC). Such are regarded as being polymorphic and are codominatly expressed. If ever the T cells are to be vested with the ability to sense and act against foreign antigens, then the presence of MHC molecules is deemed crucial. This is so since the MHC class one and MHC class two are responsible for availing peptides to the T cells. The importance of such an occurrence is critical in transplantation since it’s the means through which compatibility issues are tested (Chapel et al. 2006).

Of utmost importance, also, is the need for the two classes of MHC molecules between the donor and the recipient to match as this aids acceptance in transplantation. This is true of some organs like the kidney transplantation,

although the same may not apply with the liver transplantation whose success is vested upon other principles (Gorczynski & Stanley 2006).

Types of organ transplantation rejections

i. Hyper acute rejection

This is a commonly experienced type of rejection during transplantation. It's mainly caused by incompatibility of the MHC molecules between the donor and the recipient and also that of the I&G antibodies. Such a rejection can be avoided by carrying out thorough screening of the two parties before transplantation is effected (Higgins et al. 1996).

ii. Acute rejection

This is a type of rejection that happens some days or even weeks after transplantation is done. It's known to cause an inflammation in the body and is facilitated by some active T cells. It mainly focuses on the endothelium but in some instances it also causes some harm to the arteries (Coico, Sunshine & Benjamini 2009).

iii. Chronic rejection

This kind of rejection is a result of the earlier discussed acute rejection. When inflammation occurs in the arteries, it leads to development of fibrosis (Coico, Sunshine & Benjamini 2009).

The mechanism of immunosuppressive drugs

Immunosuppressive drugs are a special type of drugs that are used by victims of transplantation to colonize the presence of T cells in the body. For

instance, there is the OKT3 antibody obtained from mice that has great effects on the CD3 T cell. When TNF-α, IL-2 and interferon gamma are present in the circulation, it stimulates production of cytokine. Then there are the basiliximab and daclizumab that work against CD25 monoclonal antibodies and hence the α-chain of the high affinity IL-2 receptor (Jiang & Lombardi 2006).

DNA vaccines as an immunotherapy

Background of DNA vaccine

DNA immunization is a technique in the medical world most commonly applied in stimulating humoral and cell responses as regards particular protein antigens. It’s a type of gene automatically produced by living things once some genes are injected into them. Experiments carried put early in the 20th century serve as prove to the effectiveness of DNA immunization and quantify that the use of a genetic hormone stimulates the production of a DNA. This explains why this type of immunization is sometimes referred to as genetic immunization (Gurunathan et al. 2000).

The mechanism of DNA vaccines

This process begins with injection of a specified protein into the body. These are then broken down into peptides which have the ability to penetrate the reticulum membrane. In the endoplasm the peptides come into contact with the class one MHC molecules to which they get attached. At this point, immunity is effected by T cells that contain cytokine and inhibit viruses (Gorczynski & Stanley 2006).

At this point the role of the MHC class II molecules is to activate the T helper cells (CD4+) into action. These CD4+ cells have the ability to detect the APC produced peptides though their functionality is affected by their types. Depending on the CD4+ cells in action, production of antibodies is (Kindt, Goldsby & Osborne 2007).

DNA vaccine in Tuberculosis

According to research, DNA vaccines have been effective to TB patients as regards clinical experiments carried out on animals (Zabriskie 2009). Prove to such a report has been associated to two happenings; in one case antigen 85A was so effective when used on mice and a mixture of antigen 85B and BCG was effective on pigs. This clearly indicates that the type of species concerned in a particular treatment has great influence on the effectiveness of the vaccine administered. It’s also true that the type of vaccine used and the molecules involved in the whole process have a major influence on effectiveness (Gupta, Katoch & McMurray 2007).

Conclusion

True of the research conducted, immunotherapy does qualify to be called an advanced mechanism of treatment. The working principle behind this mechanism requires that the immune system of victims suffering from particular conditions be activated and improved for efficiency. This is to boost their bodies to react to the presence of certain antigens that have great effects on the conditions from which they may be suffering. Research in the area of immunology was initiated in the early 20th century and has crossed over to the 21st century, all this in a bid to gain more understanding

on this treatment mechanism and to expand on its use. Immunotherapy studies are not limited to particular conditions, but on the contrary carry out experiments on diverse areas of health. However, organ transplantation and its related fields have been accorded more attention especially regarding the possibility of suppressing the T cells that are in action. Of recent focus also is the DNA vaccination, cancerous infections, HIV virus and tuberculosis. Focus into such complications accords immunology much importance, being that it is covering the most dreaded and complex health issues.

References

Chapel, H, Haeney, M, Misbah, S & Snowden, N 2006, Essentials of clinical immunology 5edn, Blackwell Pub, Malden, Mass.

Coico, R, Sunshine, G & Benjamini, E 2009, Immunology : a short course 6edn, Wiley Blackwell, New Jersey.

Gorczynski, RM & Stanley, J 2006, Problem-based immunology Saunders Co., Philadelphia : W. B.

Gupta, UD, Katoch, VM & McMurray, DN 2007, 'Current status of TB vaccines', Vaccine, vol. 25, no. 19, pp. 3742-51.

Gurunathan, S, Wu, C-Y, Freidag, BL & Seder, RA 2000, 'DNA vaccines: a key for inducing long-term cellular immunity', Current Opinion in Immunology, vol. 12, no. 4, pp. 442-7.

Higgins, RM, Bevan, DJ, Carey, BS, Lea, CK, Fallon, M, Bühler, R, Vaughan, RW, O'Donnell, PJ, Snowden, SA, Bewick, M & Hendry, BM 1996, 'Prevention of hyperacute rejection by removal of antibodies to HLA immediately before renal transplantation', The Lancet, vol. 348, no. 9036, pp. 1208-11.

Jiang, S & Lombardi, G 2006, 'New trends in immunosuppression and immunotherapy', International Immunopharmacology, vol. 6, no. 13-14, pp. 1874-8.

Kindt, TJ, Goldsby, RA & Osborne, BA 2007, Kuby immunology, 6 edn, W. H. Freeman, New York

Zabriskie, JB (ed.) 2009, Essential clinical immunology Cambridge University Press, Cambridge ; New York