Advances in diagnosis and treatment of diseases in large animals

V.D. Padmanaban

Large animals play a vital role in the economy of the country. Cattle and buffaloes together constitute the world's largest population of bovines and account for one fifth of the total population. India possesses the largest population of buffaloes. Camels and horses are available in pockets in India. Himalayan region harbours the Yak, Mithun and Mules. Products from these animals like milk, meat, hide, bones, horns, hooves etc. besides the renewable energy they offer in the form of their muscle power account for more than Rs.150 crore of rupees per day. This contribution is not at optimum utilization level but at 40 per cent of the optimum level of utilization. The main hurdles in optimum utilization include poor genetic stock, lack of feed and fodder, lack of education of farmers who rear these animals and more particularly diseases which not only cause morbidity resulting in lowered production but also mortality resulting in loss of the capital invested. According to FAO of the UN, milk production in India is expected to touch 76 million tonnes in 1999-2000 as against 73 million tonnes in the U.S. India accounts for more than 13 per cent of total worlds' production of 558 million tonnes.

Among the diseases, contagious and infectious diseases affect these animals in an epidemic form involving large number of animals at a given time. Other diseases to a great extent affect these animals on individual animal basis barring managemental problems, which again can affect the herd as such. Contagious and infectious diseases are caused by bacteria, mycoplasma, parasites, fungi and viruses. Specific diagnosis of the etiological agent at an early stage paves way for a rational treatment and for taking effective steps for prevention and control of the disease.

Modern methods of diagnosis:

Whatever is the situation; the clinician is the ultimate authority to decide on the diagnosis and may rely to a certain extent only, on the results of laboratory examination of specimens collected from the affected and in contact animals. Hence it is advised that the clinician should endeavour to correlate the results of the laboratory examination of materials collected from the affected and in contact animals with the disease profile presented by the individual animal, by the herd and the pattern of disease prevalence in the locality. Whenever, there is a doubt about the correlation of the results of laboratory examination and the clinical conditions, the clinicians are strongly advised to recheck the entire process of diagnosis and arrive at a logical conclusion.

The primary objective of the clinician should be to short list a few of the diseases which could cause the clinical syndrome available in the instant case and by process of elimination and confirmation, arrive at a final diagnosis which is expected to be more accurate and meaningful.

The conventional methods of diagnosis include microscopical examination of materials for the presence of the etiological agent or its developmental forms, tests to identify the presence of specific antibodies to the etiological agents by tests like agglutination, precipitation and complement fixation and biological tests to test the virulence as well as specific pathological conditions caused by the pathogen in the experimental animals.

Modern methods of diagnosis emphasize on rapidity of the test, specificity, repeatability, easy to perform and cost effective. In this regard many pen side diagnostic kits have been developed which can put into use by the field veterinarians. Latex agglutination test has been used for many diseases. This test involves the coating of the antigen /antibody on latex particles and when the antigen/antibody comes in contact with the corresponding antibody/antigen, the latex particles agglutinate to form a visible reaction. With suitable controls, the field veterinarians could easily read these results. The main draw back appears to be the shelf life of the reagents used under atmospheric conditions as well as at refrigeration temperatures. Secondary draw back

Dr. V.D. Padmanaban
Editor, Indian Veterinary Journal, Chennai.

of these tests is that they are cursory and may not be very accurate and would require a confirmatory test. Similarly, dot blot assays are being developed as pen side diagnostic kit wherein the antibody or antigen is blotted on a nitrocellulose membrane and to that blot the required reagents are added to develop a coloured dot on the nitrocellulose membrane. Use of monoclonal antibodies in these kits could make these tests more confirmatory but the monoclonal antibodies are not only costly but also are not available readily.

Sophisticated laboratory tests have been developed to pin point correct diagnosis which would throw not only light on the etiological agent but also on epidemiological identity of the pathogen which could help in tracing the route taken by the pathogen to affect a designated herd.

Such tests involve the use of monoclonal antibodies that identify the strain of the etiological agent and would throw more light on the epidemiology of the disease and would indicate more accurately up to strain level. Monoclonal antibodies are produced by a single clone of lymphocytes turning into single clone of plasma cells on recognition of the particular epitope of the etiological agent. Consequently these antibodies are very pure with respect to that particular epitope and any positive reaction would indicate the presence of that particular epitope and consequently the particular strain of the pathogen having that unique epitope.

Besides monoclonal antibodies modern diagnostic tests involve testing for the presence of unique protein sequences, unique nucleic acids be it DNA or RNA. The tests include protein probes, nucleic acid probes, use of polymerase chain reaction and its improvements, restriction endonuclease analysis etc. The details of these tests would be discussed. These tests are accurate but could be performed at sophisticated laboratories only and are costly.

Disease	**Conventional diagnosis**	**Modern diagnosis**
Anthrax	Examination of blood smear Biological test in guinea pigs	PCR, DNA probes
Black quarter	Examination of muscle impression Smear followed by biological test In guinea pigs	PCR
Hemorrhagic Septicemia	Examination of heart blood smears Biological test in rabbits	Immunoblots
Tuberculosis	Acid fast staining of smears Culture Biological test in guinea pig Rabbits or Fowl as the case may be	Elisa tests Western blots PCR Indirect HA tests
Brucellosis	Paired sera samples agglutination Test, Cultural examination, Or biological test in guinea pigs	Elisa tests PCR
Salmonellosis	Agglutination tests, IHA and Conglutination tests	Elisa, PCR DNA probes
Campylobacter (Vibrio)	Cultural examination and Biological tests	PCR, Latex agglutination
Rickettsiosis	Microscopical, cultural and biological tests	PCR Dot blot assays
Rinderpest	Precipitation test Biological test CDNA probes	Elisa, RTPCR Antigen capture Elisa
PPR	Nil	Elisa, RTPCR Antigen capture Elisa CDNA probes
Foot and Mouth Disease	Virus isolation, CFT	Elisa, RTPCR, CDNA probes

Modern Treatment of Diseases:

Treatment of diseases could be palliative, symptomatic or rational. Palliative treatment aims at reducing the suffering of the patient. Symptomatic treatment involves specific reference to the symptoms and aims at preventing the occurrence of the symptoms. Rational treatment involves the specific identification of the etiological agent and aims at the removal of the etiological agent. Consequently, treatment at field level by the Veterinarians start as palliative and symptomatic treatment and end up as rational treatment once the etiological agent is identified. In all the three types of treatment it is necessary to include supportive therapy in the form of replacement of fluids, electrolytes, macro and micro minerals, vitamins and hormones.

Modern treatment involves in vitro testing of the efficacy of the drugs against the pathogen and using a suitable drug to eliminate the pathogen and mitigate the suffering and finally make the animal totally healthy. After testing the in vitro efficacy of the drugs, it is necessary to study the in vivo efficacy also. For testing the in vivo efficacy, biological experiments using a closely related laboratory animal or the particular species of animals in which the drug is going to be used. While conducting the biological experiments, it becomes necessary to select an ideal route for administration of the drug. Modern medicine increasingly uses the routes such as drinking water medication, medicated feed, aerosol technique etc for effective administration of the drug at least when more number of animals are involved. Similarly for sustained as well as quick action, appropriate routes are to be selected.

It is not advisable to apply the drugs available for human beings to the animals as well especially the ruminants, more particularly when the drugs are to be administered through the alimentary tract. The clinicians have got to remember that the pH of the stomach of man and pH of the rumen of the ruminants are not the same. While the pH of human gastric fluid is acidic between 2 and 3, the pH of the rumen is around 6.8 to 7.4. Consequently, the drugs, which could act in the acidic environment, would not act effectively in the rumen eco system.

Magic Bullets:

Modern biology has made it possible to design magic bullets i.e. drugs which would act at a particular location in the body or on a particular tissue. The magic bullets are based on the principle that when drugs are irreversibly coupled with the antibodies to the pathogen or the altered tissue and the effective radical of the drug is made available for action, the antibodies go in search of the antigen i.e. the pathogen or the altered tissue, where the drug is delivered specifically and the effective action of the drug would be manifold.

Gene therapy:

With the advent of Biotechnology and intensive research on the genes responsible for diseases or disease processes have been identified and gene therapy is advocated either in the form of knock out of the unwanted genes or the implantation of the desired genes so that the body could get itself corrected of the genetic abnormality.

Spare parts technology:

Replacement of the damaged tissue or organ has been the latest technique to reverse some of the irreversible pathological conditions like leukemia, renal failure, cardiac valve pathology, transplantation of cornea, spleen, liver etc.

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