ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 2, Issue 4, pp: (86-89), Month: October - December 2014, Available at: www.researchpublish.com

Endoluminal Stents in Veterinary Practice: A Short Note

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Abstract: **Tremendous efforts for adaptation, development, updating and implementation of minimally invasive surgical approaches in the diagnosis and treatment of challenging diseases and/or disorders of animals have been made for advanced veterinary clinical practice. Endoluminal stent placement in luminal bodily passages in animals is one such advancement and is under experimental trials in India for its veterinary applications. The current short note deals with the usage of stent on animals in experimental laboratories and veterinary clinics.**

Keywords: **Endoluminal stent, advancement, bodily passage, veterinary, India.**

I. INTRODUCTION

Cases of luminal constrictions, vascular coagulation abnormalities, foreign body occlusion, urinary incontinence etc. are frequently encountered at clinics. General approach to cope up with such critical conditions includes surgical procedures which are mostly invasive in nature, with some inevitable post-operative complications under Indian circumstances. Endoluminal stent placement by use of a stent or a scaffolding device that supports bodily conduits is a minimally invasive technique and a stent used for this purpose and placed in a constricted bodily passage, is a mesh-like tube often made of metal that can expand once, either of its own or with the help of a balloon from catheter guided system [1]. The basic objective of endoluminal stent placement is to prevent and/or repair luminal constrictions through a part of number of hollow passages in order to smoothen the flow of liquid (e.g. blood in blood vessels), gas (e.g. air in trachea) or solid (e.g. ingesta in digestive tract). If used in large luminal tissues, it is a simple, quick, non-surgical option for palliative management in animals even with advanced metastatic or systemic diseases in which surgical resection may or may not be possible or warranted [2].

Nomenclature and Historical aspects:

Beginning with nomenclature, the word/procedure 'stenting' was used initially for stiffening garments and this meaning is now obsolete. According to the description given in the Merriam Webster Third New International Dictionary, the word 'stent' is evolved from Middle English verb 'Stenten'. Stenten is shortened from 'Extenten' which was basically derived from Latin word '*Extentus*', a past particle of '*Extendere*' which means 'To stretch out'. In 1969, Dr. Charles Dotter was the first person who introduced the concept of endoluminal mechanical device to hold open an artery. For experimental purpose he used a stent like stainless steel device in the canine popliteal artery. Julio Palmaz invented the first balloon-expandable stent in 1985. In 1986, Ulrich Sigwart invented self-expanding stents which were initially termed as 'Wallstents' and along with Jacques Puel, he was the first person to insert the first ever stent in human coronary artery in Tollouse, france.

Manufacturing aspects:

Winding, heating and polishing are three basic stent manufacturing steps. Factors such as material characteristics, bulk and surface properties, stent configurations, location and size of constriction, possibilities of inevitable complications etc. are major factors to be taken into account for stent manufacturing and stent placement procedures. Metals used for stent manufacturing include stainless steel, nitinol, gold, cobalt, chromium and tantalum. Polylactide, polylactone and silicon are the most commonly used coating materials for stents while polyethylene, polyurethane, polyesters and many other

coating polymers presented adverse side effects [3] and are under experimental trials. An ideal stent (i) should be easily delivered from the delivery system; (ii) should have appropriate expandability, strength and elasticity; (iii) should not induce restenosis; (iv) should be non-irritant; (v) should be haemocompatible and allow complete re-endothelialization in vascular system and (vi) should allow positive remodeling.

II. CATEGORIZATION

A well established classification of endoluminal stents is not available in literature. However, endoluminal stents can be categorized (A) based on material coating as (i) bare metal stents, (ii) coated stents and (iii) drug-eluting stents [4]; (B) based on expanding procedure as (i) self-expanding stents and (ii) balloon-expandable stents; (C) based on biodegradability as (i) biodegradable stents and (ii) biostable stents [5]; and (D) based on location as (i) nasopharyngeal stents [6] , (ii) tracheal stents [7], (iii) esophageal stents, (iv) vascular stents [8], (v) colorectal stents, (vi) ureteral stents [9] and (vii) urethral stents [10].

III. INDICATIONS

General indications of stent placement in luminal passages include (i) recurrent benign strictures that are not surgically resectable; (ii) active inflammation or edema necessitating acute and possibly temporary support while the pathologic process is resolved; (iii) rapidly growing or recurrent obstructive tumors; (iv) tumors producing extrinsic obstructions; (v) early anastomotic strictures that might stabilize over a stent during post-operative remodeling etc.

Following the first report on experimental stent placement in canine popliteal artery by Charles Dotter in 1969, the procedure is now performed in trachea [11], colon and rectum [12], nasopharyngeal passage [13], esophagus [14] as well as ureter and urethra in animals for various conditions. Tracheal collapse in toy breeds remains the most important and frequently reported clinical indication in dogs and stent placement is indicated in times of crisis for which self-expanding nitinol stents are ideally used [15]. The most appropriate stent for ureteral obstructions in dogs is double pigtail soft stents [9]. Stent placement is also practiced in cats [16], horse [17] and other laboratory animals [18].

IV. DIAGNOSTIC IMAGING FOR STENT PLACEMENT

The most commonly used imaging technique during stent placement is fluoroscopy. Reports on use of other imaging techniques such as Computed Tomography (CT) scan, Magnetic Resonance Imaging (MRI) [19], ultrasonography [20] and endoscopy are available with different advantages and disadvantages. Fluoroscopy-guided and endoscope-guided stent placement procedures are currently practiced and require use of anesthesia or sedatives with appropriate instrumentation.

Advantages

Stent placement is safe, effective and is a minimally invasive alternative to invasive surgical procedures used to relive constrictions in passages. The procedure becomes comparatively easier after proper training with appropriate instrumentation. This procedure takes shorter time period and leads to shortened anesthetic time and recovery time which also helps to reduce the risks associated with use of anesthetic agents. Stent placement sometimes shows excellent recovery when the patient has failed to respond aggressive therapeutic approach. This procedure can be used for palliation with improved quality of life. In some cases, animal can resume to their normal activity and behavior very quickly. Reports suggest that continuous medication becomes necessary when clinical signs persist after stent implantation for palliation.

Disadvantages

Giving due consideration to the post-operative management various short- and long-term complications can be observed and may necessitate stent exchange or use of an alternative device. Cell damage, inflammation, bleeding, perforations, fistulation, sepsis, restenosis, sub-acute thrombotic occlusions are frequently encountered complications with use of vascular stents for which use of coated stents, biodegradable stents and drug-eluting stents is beneficial. Stent migration, stent fracture, tumor ingrowth, tumor outgrowth, aspiration due to overdose of sedatives, compression of adjacent

structures, stent induced traumatic injuries, sepsis and erosions are frequent complications associated with placement of stents in large luminal constrictions. Reports suggest endoscopy is the best suitable technique for reliving post-stent-placement complications with help of rat tooth forceps.

V. CONCLUSIONS

Stent placement is an effective alternative to invasive surgical procedures. Cost and prompt availability of stents remain as major limitations. Biodegradable drug-eluting stent placement is practiced in veterinary clinics of developed countries. Such stents will prevent the major complications associated with bare metal stents and should be considered for clinical trials on animals after experimental confirmations in India.

ACKNOWLEDGEMENTS

I am thankful to CVSAH, Anand and AAU, Gujarat for kind support and above all Dr. D. Patil for his kind support and guidance. I am indebted to my parents, retired senior publication officers for their constant inspiration.

REFERENCES

[1] Berent, A. C., Weisse, C. W., Todd, K. and Bagley, D. H. (2014). Technical and clinical outcomes of ureteral stenting in cats with benign ureteral obstruction: 69 cases (2006-2012). J. Am. Vet. Med. Assoc., 244(5):559-576

[2] Hume, D. Z., Solomon, J. A and Weisse, C. W. (2006).Palliative use of a stent for colonic obstruction caused by adenocarcinoma in two cats.J. Am. Vet. Med. Assoc., 228(3):392-396

[3] Suzuki, T., Kopia, G., Hayashi, S. and Bailey, L. R. (2001). Stent-based delivery of sirolimus reduces neointimal formation in a porcine coronary model. Circulation.104:1188-1193

[4] Bertrand, O. F., Sipehia, P. and Mongrain, R. (1998). Biocompatibility aspects of new stent technology. J. Am. Coll. Cardiol., 32:562-571

[5] Serruys, P. W. and Kutryk, M. J. B. (1998).Handbook of coronary stents. London: Martin Dunitz. pp. 265-273

[6] Berent, A. C., Weisse, C. W., Todd, K., Rondeau, M. P. and Reiter, A. M. (2008). Use of a balloon-expandable metallic stent for treatment of nasopharyngeal stenosis in dogs and cats: six cases (2005-2007). J. Am. Vet. Med. Assoc., 233(9):1432-1440

[7] Sura, P. A. and Krahwinkel, D. J. (2008). Self-expanding nitinol stents for the treatment of tracheal collapse in dogs: 12 cases (2001-2004). J. Am. Vet. Med. Assoc., 232(2):228-236

[8] Sisson, D. (2003). Use of a self-expanding occluding stent for non-surgical closure of patent ductus arteriosus in dogs. J. Am. Vet. Med. Assoc., 223(7):999-1005

[9] Berent, A. C., Weisse, C. W., Beal, M. W., Brown, D. C. and Todd, K. (2011). Use of indwelling, double-pigtail stents for treatment of malignant ureteral obstruction in dogs: 12 cases (2006-2009). J. Am. Vet. Med. Assoc., 238(8):1017-1025

[10] McMillan, S. K., Knapp, D. W., Ramos-Vara, J. A., Bonney, P. L. and Adams, L. G. (2012). Outcome of urethral stent placement for management of urethral obstruction secondary to transitional cell carcinoma in dogs: 19 cases (2007-2010). J. Am. Vet. Med. Assoc., 241(12):1627-1632

[11] Gellasch, K. L., Gomez, T. C., McAnulty, J. F. and Bjorling, D. E. (2002).Use of intraluminal nitinol stents in the treatment of tracheal collapse in a dog. J. Am. Vet. Med. Assoc., 221(12):1719-1723

[12] Culp, W. T. N., MacPhail, C. M., Perry, J. A. and Jensen, T. D. (2011).Use of a nitinol stent to palliate a colorectal neoplastic obstruction in a dog. J. Am. Vet. Med. Assoc., 239(2):222-227

[13] Cook, A. K., Mankin, K. T., Saunders, A. B., Waugh, C. E., Cuddy, L. C. and Ellison, G. W. (2013). Palatal erosion and oronasal fistulation following covered nasopharyngeal stent placement in two dogs. Irish Vet. J., 66:8

[14] Lam, N. K., Weisse, C. W., Berent, A. C., Kaae, J., Murphy, S., Radlinsky, M., Richter, K., Dunn, M. and Gingerich, K. (2013). Esophageal stenting for treatment of refractory benign esophageal strictures in dogs. J. Vet. Intern. Med., 27(5):1064-1070

[15] Monaco, T. A., Taylor, J. A., Langenbach, A., Gordon, S. and Vance, E. (2014).Intra- and inter-observer reliability of combined segmental measurement techniques for predicting immediate post-development intraluminal tracheal stent length in dogs. Can. Vet. J., 55(5):435-441

[16] Monassero, M., Decambron, A., Viateau, V., Bedu, A. S., Vallefuoco, R., Benchekroun, G., Moissonnier, P. and Maurey, C. (2013). Indwelling double-pigtail ureteral stent combined or not with surgery for feline urolithiasis: Complications and outcome in 15 cases. J. Feline Med. Surg., 16(8):623-630

[17] Lempe, A., Brehm, W. and Scharmer, D. (2012).Stent reconstruction of an injured parotid duct in a thoroughbred colt. Vet. Surg., 41(4):536-539

[18] Kwon, J. S., Kim, Y. S., Cho, H. H., Kee, H. J., Hong, M. H., Kang, W. S., Jeong, H. Y., Jeong, M. H. and Ahn, Y. (2013). Cilostazol protects vessels against hyperglycemic injury and accelerates healing after implantation of drug-eluting stent in a type 1 diabetes mellitus rat aorta stent model. Atherosclerosis, 228(2):332-328

[19] Amano, Y., Ishihara, M., Hayashi, H., Gemma, K., Kawamata, H., Amano, M. and Kumazaki, H. (1999).Metallic artifacts of coronary and iliac arteries stents in MR angiography and contrast-enhanced CT. Clin. Imaging, 23:85-89

[20] Oemrawsingh, P. V., Mintz, G. S., Schalij, M. J., Zwinderman, A. H., Jukema, J. W. and Wall, E. E. (2003). Intravascular ultrasound guidance improves angiographic and clinical outcome of stent implantation for large coronary artery stenosis: final results of a randomized comparison with angiographic guidance (TULIP Study). Circulation.107:62-67