UNIVERSITI PUTRA MALAYSIA

PROGRAMMABLE MULTI-BLADDER PNEUMATIC TOURNIQUET CUFF

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PROGRAMMABLE MULTI-BLADDER PNEUMATIC TOURNIQUET CUFF

By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the degree of Master of Science

June 2012

To my beloved family

Father and Mother

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Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfillment
Of the requirement for the degree of Master of Science

PROGRAMMABLE MULTI-BLADDER PNEUMATIC TOURNIQUET CUFF

By

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June 2012

Chairman: Assoc. Prof. Abdul Rahman bin Ramli, PhD

Faculty: Institute of Advanced Technology

Pneumatic Tourniquet cuff device is used in limb orthopedic surgery especially in the upper limb to provide a bloodless field it can be obscured by blood.The tourniquet cuff occludes both venous and arterial supply. In the process there is also compression of the nerve and this can result in pneumatic tourniquet cuff system paralysis. When the operation is done under regional or local anesthesia the patient may experience discomfort at the site of application. This shortens the duration of the pain tolerence and hence lengthy operation can not be carried out under local or regional anesthesia. Since many operations may be carried out under local or regional anesthesia, a pneumatic tourniquet cuff system had been defigned which may help to increase the pain tolerence. The multicompartment pneumatic tourniquet cuff system with multiple bladders each with its own pumps to inflate and deflate each tourniquet cuff is implemented to produce a bloodless field. A microcontroller controls each tourniquet cuff to be inflated and deflated. The pressure effect on the

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underlying structures is then reduced while maintaining a bloodless field. This tourniquet cuff system comprises of pump unit, microcontroller and a cuff with three compartments. The pump unit is AC powered operates to inflate at a preset pressure. There is a valve and a pressure transducer which is responsible to maintain the pressure at a preset level. Depending on the signal recieved from the microcontroller the sequence of open and close the three valves are regulated. The tourniquet had 3 compartments non structuring fabric is used to form the three compartments into 3 bladders are inserted. The bladder is a sealed bladder with only inlet or outlet which is provided by the tubing. The operation of the system is controlled by a microcontroller. This unit is turned on and the pressure required is set. The inflate button is turned on. Based on the programming done the inflation of the proximal torniquet followed by the middle and distal tourniquet is done followed by the reverse sequence,thus maintaining the occlusion to provide a bloodless field but relieving pressure at the site of the tourniquet. Hence reducing the discomfort and relieving the pressure on the underlying structures especially the nerve.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

SISTEM MANSET PENASAK DARAH BERISI UDARA BOLEH ATURACARA

oleh

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Alat manset penasak darah berisi udara digunakan dalam pembedahan ortopedi lengan terutamanya dalam lengan atas ke kawasan tidak berdarah untuk menggambarkan struktur minit yang digelapkan oleh darah. Manset penasak darah ini menutup jalan kedua-dua pembekalan vena dan arteri. Dalam process ini terdapat juga kemampatan urat saraf dan ini boleh mengakibatkan kelumpuhan sistem manset berisi udara. Semasa pembedahan ini dijalankan dalam keadaan pembiusan kedaerahan atau setempat pesakit mungkin mengalami ketidakselesaan pada sisi pemakaian. Ini memendekkan jangka masa kesabaran sakit dan oleh kerana itu banyak pembedahan tidak dapat dijalankan dalam keadaan pembiusan kedaerahan atau setempat. Oleh sebab banyak pembedahan mungkin dijalankan dalam keadaan pembiusan kedaerahan atau setempat, sistem manset penasak darah berisi udara yang

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mungkin membantu untuk meningkatkan kesabaran sakit telah direkabentuk. Sistem manset penasak darah berisi udara pelbagai ruang dengan pelbagai pundi setiap satunya dengan pam sendiri untuk mengembung dan mengempis setiap manset penasak darah dilaksanakan untuk menghasilkan kawasan tidak berdarah. Satu mikropengawal mengawal setiap manset panasak darah yang dikembung and dikempis. Pengaruh tekanan atas struktur yang mendasari dikurangkan sementara mempertahankan satu kawasan tidak berdarah. Sistem manset panasak darah ini manganduingi unit pam, mikropengawal dan satu manset dengan tiga ruang. Unit pam ini ialah satu penjalanan janaan kuasa AC untuk mengembung pada tekanan pratetap. Terdapat satu injap dan satu transduser yang bertanggungjawab untuk mempertahankan tekanan pada tahap pratetap. Bergantung kepada isyarat yang diterima daripada mikropengawal susunan pembukaan dan penutupan ketiga-tiga injap diaturkan. Panasak darah yang mengandungi tiga ruang rekaan tidak berstruktur digunakan untuk menbentuk tiga ruang dimana tiga pundit dimasukkan. Pundi ini ialah pundi tertutup dengan hanya saluran masuk dan keluar yang dibekalkan oleh tiub. Penjalanan sistem ini dikawal oleh satu mikropengawal. Unit ini dihidupkan dan tekanan yang diperlu ditetapkan. Butang pemgembungan dihidupkan. Berdasarkan aturcara yang dibuat pengembungan panasak darah paling terlebih dekat diikuti dengan panasak darah tengah dan paling terlebih jauh disiapkan dengan mengikuti susuan terbalik, demikian mempertahankan penutupan untuk membekalkan satu kawasan tidak berdarah malah meringankan tekanan pada sisi penasak darah ini, oleh itu mengurangkan ketidakselesaan dan meringankan tekanan atas struktur yang mendasari terutamanya urat saraf.

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I certify that an Examination Committee has met on (…….) to conduct the final examination of **Amir Mohammad Ebrahimi Tajaddod** on his Master of Science thesis entitled " Programmable Pneumatic Tourniquet Cuff" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the Master of Science degree.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at University Putra Malaysia or at any other institutions.

AMIR M.E.TJADDOD

Date : 29 June 2012

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