Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

Can the use of a rapid nutrition screening tool facilitate timely dietetic referrals on the acute renal wards? – A validation study

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Science

in

Nutrition and Dietetics

at Massey University, Albany

New Zealand

Yizhou Andrew Xia

2014

Abstract

Background: The percentage of malnourished patients in the acute renal hospital wards has been reported as 52.6% and associated with increased hospital stay and morbidity. There are currently no published nutrition screening tools that are sensitive enough to detect undernutrition risk in this patient group.

Aim: To develop and validate a rapid nutrition screening tool that is sensitive and specific to recognise renal inpatients at undernutrition risk.

Method: The renal nutrition screening tool (R-NST) was modified from the malnutrition screening tool (MST) that has been validated in the acute care setting. It includes the traditional risk variables such as involuntary weight loss and reduction in food intake, as well as biochemical measures to increase the effectiveness of recognising undernutrition risk. It was designed in three simple, accumulative steps. The new R-NST was validated using a prospective, blind comparison to a gold standard study design (N = 122). The undernutrition risk of each participant identified by the research assistants using the R-NST was compared to the nutritional status independently assessed by the researchers using the 7-point subjective global assessment (SGA) as a gold standard and hand grip strength (HGS) as a functional indicator. The R-NST was autonomously undertaken by nursing staff to determine its feasibility as a routine screening on ward level.

Results: The SGA and R-NST tools classified 63.9% and 68.0% of participants as malnourished or at undernutrition risk, respectively. The R-NST was valid to detect undernutrition risk (sensitivity = 97.3%, specificity = 74.4%, positive predictive value (PPV) = 88.0%, negative predictive value (NPV) = 93.6%) compared to the SGA. The HGS in malnourished participants were lower than those that are well nourished in either women ($p = 0.001$) or participants aged under 65 years ($p = 0.009$). The R-NST showed ability to recognise participants requiring dietetic intervention due to their renal conditions. The compliance rate in the R-NST screening by the nursing staff was low (22.6%).

Conclusion: The R-NST is a good diagnostic tool for identifying acute renal patients at undernutrition risk and facilitating timely dietetic referral. Further research is warranted to explore innovative yet effective interventions to enhance nutrition screening compliance in ward practice.

Key words: nutrition screening tool, undernutrition, renal failure

Acknowledgments

I would like to express my gratitude to everyone who has helped and encouraged me during this thesis project. In particular, I would like to thank:

My supervisors: Associate Professor Rozanne Kruger and Alayne Healy. Your encouragement, guidance and the tremendous support over the past two years have been invaluable. I never expected to have learnt so much and I am so appreciative to have had the opportunity to work with you both.

Chelsea Hayes, Louise van Dorp and Nawar Almesfer, for volunteering to assist with the recruitment and screening of 122 participants. The research advisor and biostatistician at Counties Manukau DHB: Kathryn Askelund for making the application of the ethical approval from the Health and Disability Ethics Committees seem like a breeze; and Irene Zeng for revealing the joys of statistics.

The Management team in the Nutrition and Dietetic services and the Renal services at Middlemore hospital for facilitating the project and ensuring the smooth running every step of the way. The wonderful team of dietitians at Middlemore hospital, for always willing to lend a helping hand. You made the 14 weeks of data collection go faster.

The superb 122 participants who took part in this research study, it would not have been possible without you. All the nursing staff on Ward One at Middlemore hospital for putting the time and effort into taking part. I am very grateful for being treated like a 'real' working dietitian.

My family: Mum, Dad, Paul, Ian, Jan and many more. Your support over the last two years has been endless and I am extremely grateful. Thank-you, Paul, especially for your unwavering support, for letting me explain everything to you, for pretending to understand and offering advice you know I will ignore. To my incredible group of friends and classmates, your moral support has made this thesis possible, I am lucky to have you all.

Table of Contents

Abstract.....i

Acknowledgments.....iii

List of tables.....viii

List of figures.....ix

List of appendices.....x

Chapter One.....1

1. Introduction.....1

1.1 Justification of the study.....2

1.2 Statement of the research problem.....7

1.3 Purpose of the research study.....8

1.3.1 Aim.....8

1.3.2 Objectives.....9

1.3.2.1 Primary objectives.....9

1.3.2.2 Secondary objective.....9

1.4 Structure of the thesis.....9

Chapter Two.....10

2. Literature review.....10

2.1 Introduction.....10

2.1.1 Definition of renal failure.....10

2.1.2 Prevalence of chronic kidney disease in New Zealand and other countries.....12

2.1.3 Definition of undernutrition and risk of undernutrition.....13

2.1.4 Definition and terminology of undernutrition in adults with renal failure.....14

2.1.5 Causes of undernutrition in adults with renal failure.....15

2.2 Nutrition screening vs. nutrition assessment.....17

2.3 Evaluation of nutritional status in adults with renal failure.....18

2.3.1 Nutritional assessment tools: SGA and its variations.....18

2.3.2 Other nutritional assessments: MNA.....21

2.3.3 Prevalence of undernutrition in adults with renal failure in the acute setting.....21

2.4 Nutrition screening tools.....24

2.4.1 Application of various nutrition screening tools in different population groups and care settings 24
2.4.2 Nutrition screening tools Available for Adults with Renal Failure 25
2.5 Approaches to Develop a Nutrition screening tool 26
2.5.1 Risk variables associated with undernutrition in adults 28
2.5.1.1 Determination of weight and weight Loss in a nutrition screening tool 29
2.5.1.2 Dry weight in adults with renal failure 31
2.5.1.3 Determination of food intake in a nutrition screening tool 32
2.5.1.4 Additional considerations for the determination of undernutrition risk 33
2.5.2 Incorporation of biochemical measures in a nutrition screening tool 34
2.5.2.1 Biochemical measures in adults with renal failure 35
2.6 Approaches to validate a nutrition screening tool 38
2.6.1 Validity of Nutritional Assessment Tools in Adults with Renal Failure 40
2.6.2 Handgrip strength assessing nutritional status of adults 43
2.6.2.1 Validity of handgrip strength in adults with renal failure 43
2.7 Conclusion 46
Chapter Three 47
3. Methodology 47
3.1 Introduction 47
3.2 Study design 47
3.3 Ethics approval 50
3.4 Participants 50
3.4.1 Participant recruitment 51
3.5 Study process 52
3.5.1 Phase One – The development of a new R-NST 53
3.5.1.1 Substantiating inclusion of questions one to five 55
3.5.1.2 Substantiating inclusion of questions six to nine 60
3.5.2 Phase Two – The validation of the newly developed R-NST 63
3.5.2.1 The R-NST 64
3.5.2.2 Seven-point SGA 64
3.5.2.3 Handgrip Strength 65
3.5.3 Phase Three – The feasibility of the newly developed R-NST in practice 66

3.5.3.1 The acceptability of the R-NST in practice 66
3.6 Data dandling and analysis 67
Chapter Four 68
4. Results 68
4.1 Introduction 68
4.2 The Retrospective review of dietetic referral system on Ward One 68
4.3 Demographic description of the study participants 70
4.4 The Validation of the newly developed R-NST in identifying renal inpatients at risk of undernutrition 71
4.4.1 Results of the R-NST 72
4.4.2 Results of the 7-point SGA 73
4.4.3 Results of the HGS 73
4.4.4 The diagnostic performance of the R-NST 74
4.4.5 Comparisons between handgrip strength and nutritional status 76
4.5 The feasibility of the newly developed R-NST in practice 78
4.5.1 The trial of R-NST in practice administered by the nursing staff on Ward One, MM Hosp 78
4.5.2 Results of the Nurses' Survey 78
Chapter Five 80
5. Discussion 80
5.1 Introduction 80
5.2 Retrospective review of dietetic referral system on Ward One, MM Hosp 80
5.3 Characteristics of the study participants 81
5.4 Development of the R-NST 82
5.5 Nutrition screening and prevalence of undernutrition on Ward One 86
5.6 Validation of the newly developed R-NST 87
5.6.1 Diagnostic performance of the R-NST in comparison to the SGA 87
5.6.2 Handgrip strength and nutritional status in adult acute renal patients 91
5.7 Feasibility of the newly developed R-NST in practice 95
Chapter Six 97
6. Conclusion 97
6.1 Research problem and aims of the research study 97

6.2 The main findings of the research study 98
6.3 Strengths 99
6.4 Limitations 100
6.5 Use of the findings of this research study 101
6.6 Recommendations 102
References 103

List of tables

Table 1.1 A summary of various nutrition screening and assessment tools.....4

Table 2.1 US Kidney Disease Outcomes Quality Initiative classification of chronic kidney disease.....11

Table 2.2 The classification of undernutrition risk in adults according to both BMI and recent unintentional weight loss.....14

Table 2.3 The prevalence of undernutrition among individuals with renal failure....23

Table 2.4 A summary of studies investigated the undernutrition criteria for objective measures in adults with renal failure.....36

Table 2.5 Definitions for different types of validity.....38

Table 4.1 Reasons for dietetic referral (November 2012 – February 2013).....69

Table 4.2 Demographic description of the participants.....70

Table 4.3 Ethnicity and renal medical condition of participants by gender.....71

Table 4.4 Results for the R-NST, the 7-point SGA and the HGS among renal inpatients in MM Hosp.....72

Table 4.5 The diagnostic performance of the R-NST and HGS in comparison to the SGA.....74

Table 4.6 Correlations between the R-NST and SGA, the R-NST and average of HGS.....76

Table 4.7 Hand Grip Strength of Participants by Nutritional Status, Gender and Age.....77

Table 4.8 Results of the nurses' survey.....79

Table 5.1 Handgrip strength reported in various research studies according to nutritional status and sex.....93

List of figures

Figure 3.1 Research design……49
Figure 3.2 Flowchart detailing the study process…….. 52
Figure 3.3 Question 1: Recent involuntary weight loss……..56
Figure 3.4 Question 2: eating behaviour……57
Figure 3.5 Question3 and 4: serum phosphate and potassium……57
Figure 3.6 Question 5: presence of peritonitis…….. 60
Figure 3.7 Question 6: the presence of gastrointestinal symptoms……..……61
Figure 3.8 Question 7: serum albumin……62
Figure 3.9 Questions 8 and 9: serum C-reactive protein and blood urea levels……63
Figure 4.1 The area under the receiver operating characteristic curve for the R-NST in comparison to the SGA……..75

List of appendices

Appendix A: Participant Information Sheet and Consent Form..... 130
Appendix B: Consent Form..... 134
Appendix C: Acute Renal Ward Nutrition Screening Form.....135
Appendix D: Seven-Point Subjective Global Assessment Rating Form.....136
Appendix E: Reference range for the grading of handgrip strength.....137
Appendix F: Acute Adult Dietitian Referral Form.....138