Development and implementation of Victorian prehospital Clinical Practice Guidelines: The supraventricular tachycardia example

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ABSTRACT

Background

In order to provide an evidence-based approach to practice, the Ambulance Victoria (AV) Clinical Practice Development Committee (CPDC) is tasked with periodic review of all of the AV Clinical Practice Guidelines (CPG's). This paper will highlight the framework underpinning CPG development in a Victorian prehospital emergency care system, and explore the development of CPG A0403 (supraventricular tachycardia) as an example of the process.

Methods

The CPDC applied a newly developed process, based upon national and internationally accepted methods of guideline assessment and development. Literature review, analysis of current practice data and extensive expert consultation were also used to formulate Guidelines.

Results

The CPDG delivered a revised CPG which removed calcium channel blocker therapy, introduced adenosine, and expanded the use of vagal manoeuvres to all operational paramedics. The VACIS data highlighted low intervention rates using pharmacology and vagal manoeuvres, with accepted reversion rates where applied. No logistic or safety issues were identified for the proposed changes, and expert consultation also supported changes to the guideline.

Conclusion

The development and implementation of new clinical guidelines in Victoria has evolved to embrace evidence based practice. The paucity of available prehospital-specific evidence means that consensus is still relied upon to complete the process, yet the evolution of further research will help to reduce reliance on this aspect and improve the quality and effectiveness of the process.

Keywords

Clinical Practice Guideline Development, Supraventricular tachycardia, prehospital

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INTRODUCTION

For nearly four decades, the development of prehospital Clinical Practice Guidelines (CPG's) in Victoria has been challenged by a lack of available prehospital-specific evidence, relying heavily upon medical expertise to guide practice, largely through consensus. Recently prehospital

research has gained momentum, and developments in technology for the recording, storage and retrieval of prehospital patient care data have improved evidence analysis capability within this field. These evolutions are early indications of the realisation of potential within this sector of health care, and highlight the ability to

utilise this to evolve quality evidence based clinical practice whilst moving away from more traditional consensus based practice.

A number of authors have described the need to develop prehospital clinical guidelines which are both evidence based and which deliver current principles of care.(1, 2) These articles describe the need to rapidly translate evidence to practice, identify gaps in knowledge, and to improve knowledge development for the prehospital setting. The development of evidence for prehospital-specific clinical guidelines is also challenged by many factors. To describe these in any detail is a separate work in itself, however it is possible to summarise that prehospital research (and the conduct of randomised clinical trials (RCT) in this field) is challenged by available funding, the unique nature of prehospital care (of symptomatic management rather than definitive care), the feasibility of conducting RCT's in the prehospital setting (with regard to measuring outcomes and ethical issues), and even the importance of RCT studies over more readily producible lower level studies which as a whole may contribute more to decision making. (1, 2)

Ambulance Victoria provides a two-tiered system of emergency prehospital care response; the Advanced Life Support (ALS) paramedic and the Mobile Intensive Care (MICA) paramedic. Essentially the skill set and training of each differs significantly, with all ALS paramedics completing a bachelor degree, whilst MICA paramedics complete further study (graduate diploma) with specific training in advanced cardiac, respiratory, trauma and disease. Authority to practice is defined within the colour-coded CPG, and this provides for clear distinction between MICA and ALS practice.

The CPG's utilised by Ambulance Victoria (AV) are reviewed every three years, in order to ensure that Victorian paramedic practice maintains currency with evolving medical practice and advances in technology. A key element of the process of guideline evaluation is an evidence-based approach to the management of specific trauma and illness. The Clinical Practice Development Committee (CPDC) is tasked with periodic review of the entire AV suite of CPG's, identifying new therapies to integrate into prehospital clinical practice, and making specific recommendations to the Medical Advisory Committee (MAC) as requested.

This paper will highlight the framework that underpins CPG development in a Victorian prehospital emergency care system, utilising the major revision of CPG A0403 (adult supraventricular tachycardia) as an example of the process.

METHODS

Evaluation of current practice

Process Governance

The CPDC report directly to the MAC, which is responsible for the provision of clinical governance for AV clinical standards and clinical practice, with particular focus on continuous quality improvement and evidence based practice. Membership of each committee is by targeted selection for a tenured period, in order to provide a diverse and expert view on all aspects of prehospital care with additional representation by specific external stakeholders. Whilst the MAC remains relatively constant in its composition, it is practice to engage additional expertise for specific clinical guideline development through consultation with organisations and individuals who specialize in a targeted area (such as consulting a respiratory physician and the Asthma Foundation when developing the asthma CPG).

The CPDC comprises representatives of the following:

- Ambulance Victoria: Department Managers, Air Ambulance Victoria representative, Mobile Intensive Care (MICA) paramedic representative and an Advanced Life Support (ALS) paramedic representative,
- AV Medical Advisors: two of three (according to availability),
- Adult Retrieval Victoria (ARV): Clinical Advisor,
- Ambulance Tasmania: Clinical Support Officer (as this State utilises the Victorian CPG document).

The MAC comprises representatives of the following:

- Ambulance Victoria: Department Managers, MICA paramedic representative, ALS paramedic representative,
- All three AV Medical Advisors,
- Adult Retrieval Victoria: Director,
- An Emergency Medicine Specialist,
- A Neurotrauma Specialist,
- A Trauma Specialist, and
- A Cardiology Specialist.

It should be noted that there is some crossover in membership of the CPDC and MAC. This is primarily a result of resourcing issues within AV, and also the availability and interest of medical specialists participating in this activity. Whilst pragmatic rather than ideal, this circumstance may be resolved in future reviews of committee structure.

AV CPG Review Process Methodology

The CPDC relies on the AV Clinical Practice Development (CPD) process, specifically developed to comply with international standards of guideline evaluation in order to produce the highest quality guidelines encompassing evidence based practice and accepted standards of CPG development.(3, 4) Although prehospital CPG development is often challenged by a lack of field-specific evidence, and in-hospital studies or expert consensus are largely relied upon for decision making, the CPD process enables a synthesis of all of the available elements to ensure that the CPG is of the highest possible standard.

Within the National Institute of Clinical Studies (NICS) report 'Assessing the Implementability of Guidelines', three key approaches to developing CPG's were highlighted (Appraisal of Guidelines for Research and Evaluation Instrument (AGREE II), Conference on Guideline Standardisation (COGS) and the Australian National Health and Medical Research Council (NHMRC) method).(3, 5, 6) The CPG development process incorporates the three core NICS principles of guideline development within this report (meeting forum and note recording, process pathway and evidence levels).(3) Also incorporated are major aspects of the AGREE II guideline development tool, with NHMRC checklists overlaid and adapted for use within the prehospital setting.(4, 6) The AV CPD process also incorporates a review of the literature, case series review of AV clinical data, and consultation with experts in the field and end users to assist in the decision making process, as demonstrated in Figure 1.

The AV CPDC also utilises an important software program (JIRA) which enables collation, review and dissemination of all aspects of process development to members of the committee. This program also serves as a visible archive of the process of development to meet future questions related to specific therapies. This enables transparency and accountability in CPG development.

The SVT (adult) guideline highlights a recent application of the process employed to develop and evaluate prehospital clinical practice in AV. This CPG was scheduled for review in 2010-11, and had remained relatively unchanged in over four decades (Figure 2).(7) Aspects of the existing CPG highlighted during the early stages of the review process were the prescriptive nature of current interventions, the continued utilisation of a calcium channel blocker (Verapamil) as the primary reversion agent (AV was the only prehospital emergency care provider in Australia continuing to utilise this drug), and the limitations of therapies to the MICA paramedic skill set.

Figure 1: AV CPG Review process.

RESULTS

Literature Review

A literature search was conducted (Cochrane library, MEDLINE, EMBASE and Google Scholar), and employed the terms 'valsalva', 'Valsalva Manoeuvre', 'vagal manoeuvre' 'adenosine', 'verapamil', 'calcium channel blocker', 'supraventricular tachycardia', 'narrow complex tachycardia', 'synchronised cardioversion', and 'cardioversion'. Also, the guideline documents of the Australian Resuscitation Council (ARC), American Heart Association (AHA), and European Resuscitation Council (ERC) were examined for current directives on overall approach to SVT management. Articles not available in English were excluded. To provide increased scope, articles were not restricted to the pre-hospital setting. The search results are demonstrated in Figure 3, and results were classified according to accepted NHMRC Levels of Evidence (LOE) categories (described in Table 1).(4) The search results were sorted and evaluated by a single member of the CPDG, and the results were provided as an analysis presented to the committee for discussion.

Figure 2: The 2012 AV CPG A0403 (Supraventricular tachycardia) Copyright: Ambulance Victoria

The 2010 ILCOR recommendations proposed four key methods for managing narrow complex tachycardia (excluding atrial fibrillation): electrical cardioversion, physiological manoeuvres, pharmacological conversion and rate control.(8) As the MAC had previously accepted inclusion of the 2010 ILCOR recommendations within AV clinical practice, these methods were noted as a framework for the revised CPG.

Two primary articles provided LOE 1 support for evaluation of pharmacological agents for termination of SVT.(9, 10) A number of LOE 1, 3 and 4 studies were included which identified the best method of performing a Valsalva Manoeuvre (VM) and a reversion effectiveness approximating 25%.(9-16) The available evidence demonstrated an absence of adverse events both within the literature and AV clinical data, which enabled a consensus decision that the VM could be applied by all AV paramedics to haemodynamically stable patients only. A regimen of 3 attempts at 2 minute intervals was proposed (being absent from the existing CPG), employing a supine posture and the 10 ml syringe blowing method already practiced by AV paramedics. This provided a pragmatic measure which ensured that paramedic scene times were not prolonged through pharmacological agents being utilised in haemodynamically stable patients within close proximity to hospital.

Adenosine was demonstrated as safe for administration in both narrow and wide complex tachycardia (9, 10, 17-22) yet should be contraindicated for patients in uncontrolled atrial fibrillation or atrial flutter where undiagnosed WPW may be present and listed as a precaution for patients in whom bronchospasm may be a problem. Adenosine has also been shown to be safe for use in use for SVT in pregnancy.(23) The individual and maximum dosage was decided after review of the CPG's of those Australian States utilising adenosine, and of the ARC Guideline for management of SVT.(24-30)

Whilst all of the studies analysed identified cardioversion for SVT as a safe practice, only a single article assessed the effectiveness of prehospital synchronised cardioversion for SVT.(31-41) The recommendation of the authors was that it was unsafe for paramedics to perform where a physician was not present; however the rationale for this was unsubstantiated within the paper. Consequently a review of VACIS data enabled assessment of existing effectiveness and safety of MICA paramedic application (albeit rare) for SVT, and also within other arrhythmias (primarily, and more commonly ventricular tachycardia). The use of synchronised cardioversion has been an integral part of the management of unstable tachyarrhythmias for the

MICA skill set since its inception in 1971. The CPDG was guided by the recommendations of international resuscitation bodies, a lack of prehospital literature, and the absence of adverse events within the AV data to develop a consensus that the existing guideline and skill set authorisation remain unchanged with regard to this therapy.

VACIS® Data Analysis

A quality assurance review of Victorian Ambulance Clinical Information System (VACIS)® data of metropolitan region SVT cases for the period November 2006 to November 2007 indicated that current therapies were underutilized (Table 2). The VACIS system provides an electronic database of all detail recorded on the electronic patient care record, and enables extraction for research, clinical audit and quality assurance purposes. The Valsalva Manoeuvre appeared well utilised within the sample, with reversion effectiveness approximating that of existing studies, however specific technique could not be quantified within the patient care document. Verapamil demonstrated reversion effectiveness comparative to the literature, but was only used in 5% of the sample cases.(9, 10) This is attributable to the prescriptive nature of the existing CPG regarding treatment related to transport time to hospital. Whilst adverse effects were not well described within the data sample, the rate of hypotensive episodes associated with verapamil administration and corrected with metaraminol was 100%, with primary use of aramine in a further 3 cases where the patient presented with initial hypotension.

Therapy	Utilisation n(%)	Reversion effectiveness n(%)
Valsalva Manoeuvre	253/261 (96.9)	59/253 (23.3)
Verapamil	13/261 (5.0)	12/13 (92.3)
Metaraminol	16/261 (6.1)	9/16 (56.2)
Synchronised Cardioversion	0 (0)	N/A

Table 2: VACIS data review of metropolitan region SVT cases (November 2006 to November 2007)

Consultative Review

Following the drafting of a proposed CPG based upon the literature review and assessment of evidence from current practice expert consultation and review was undertaken, involving a period of evaluation and comment by the cardiology departments of the Royal Melbourne Hospital and Monash Medical Centre in this instance. Specific questions included consideration of use of vagal manoeuvres, selection and dose regimen of available pharmacological agents (primarily adenosine and verapamil), requirement for 12 lead ECG to be captured in advance of reversion

Level	Intervention 1	Diagnostic accuracy 2	Prognosis	Aetiology 3	Screening Intervention
I	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies
II	A randomised controlled trial	A study of test accuracy with: an independent, blinded comparison with a valid reference standard, among consecutive persons with a defined clinical presentation.	A prospective cohort study	A prospective cohort study	A randomised controlled trial
III-1	A pseudo-randomised controlled trial (i.e. alternate allocation or some other method)	A study of test accuracy with: an independent, blinded comparison with a valid reference standard, among non-consecutive persons with a defined clinical presentation	All or none	All or none	A pseudo-randomised controlled trial (i.e. alternate allocation or some other method)
III-2	A comparative study with concurrent controls: <ul style="list-style-type: none"> Non-randomised, experimental trial Cohort study Case-control study Interrupted time series with a control group 	A comparison with reference standard that does not meet the criteria required for Level II and III-1 evidence	Analysis of prognostic factors amongst persons in a single arm of a randomised controlled trial	A retrospective cohort study	A comparative study with concurrent controls: <ul style="list-style-type: none"> Non-randomised, experimental trial Cohort study Case-control study
III-3	A comparative study without concurrent controls: <ul style="list-style-type: none"> Historical control study Two or more single arm study Interrupted time series without a parallel control group 	Diagnostic case-control study	A retrospective cohort study	A case-control study	A comparative study without concurrent controls: <ul style="list-style-type: none"> Historical control study Two or more single arm study
IV	Case series with either post-test or pre-test/post-test outcomes	Study of diagnostic yield (no reference standard)	Case series, or cohort study of persons at different stages of disease	A cross-sectional study or case series	Case series

Table 1: NHMRC Levels of Evidence

Figure 3: Literature Search

attempts, and synchronised cardioversion energy and indications. Further review of the resultant draft CPG by the Australasian College for Emergency Medicine resulted in written support from that body.

The CPG draft then underwent review and comment by individual members of the MAC and other interested external stakeholders prior to being presented formally to the MAC for ratification in its final form. There were no specific patient representative group views considered during this process as the SVT guideline would be applicable to the entire adult population with a view of fairness and equity for health care.

CPG Review Outcomes

Following completion of the CPD process and authorisation by the AV MAC, the outcomes of the review of CPG A0403 can be summarized as follows, with the final print version demonstrated in Figure 4:(42)

- The Valsalva Manoeuvre should be clearly defined and expanded for use by all AV paramedics where the patient is 'stable' as defined by a systolic blood pressure of greater than 100mmHg.
- MICA paramedics should be authorized to use pharmacological agents (adenosine) for both stable and unstable SVT if no reversion to the Valsalva manoeuvre is noted.
- Pharmacological intervention should incorporate adenosine (6mg IV, 12mg IV, and then 12mg IV until reversion or maximum total dose).
- Synchronised cardioversion should remain unchanged (75 Joules biphasic escalated to 150 Joules for subsequent shocks), and remain reserved for MICA paramedics only.
- Where there is no reversion to the maximum dose of adenosine, symptomatic management and rapid transport to hospital should occur.
- The use of Valsalva Manoeuvre and adenosine should be contraindicated for atrial fibrillation and atrial flutter identified on ECG.
- All SVT patients should have a 12-lead ECG performed where available prior to treatment unless rapidly deteriorating. Where not available, a 3-lead ECG strip should be recorded.
- Verapamil and metaraminol bitartrate (aramine) should be withdrawn from AV practice, with the exception of Air Ambulance Victoria and Adult Retrieval Victoria.

Measuring the Effectiveness of Change

Within a designated period post change (usually 12 months), a review process outside of the normal clinical audit process is undertaken to ensure that the CPG is both appropriate and

effective. If any issues arise prior to this review they are flagged by a separate clinical audit process and precipitate early review of the CPG. Significant issues affecting patient or paramedic safety result in immediate referral to the MAC or Sentinel Events Committee for immediate review and action as part of the ongoing quality review incorporated into the process.

The final stage of guideline development requires review of effectiveness of change. In 2014 the CPDC will examine all of the SVT cases for the preceding 12 months using VACIS® data to determine effectiveness of therapies, rate and significance of side effects, compliance with the CPG by paramedics, and other factors associated with the delivery of these therapies. The results will be reported to the MAC with recommendations for any potential amendments if required.

Logistic and Safety Issues

The introduction of adenosine is expected to demonstrate both initial and ongoing annual cost savings to Ambulance Victoria through the replacement of existing pharmacological agents. This costing has anticipated that all SVT patients attended by paramedics will be managed using the complete spectrum of therapeutic options available within the guideline.

Minor implications for vehicles and equipment (layout and storage) were identified with regard to varying the number of drug vials stored in the vehicles and equipment bags. These issues were resolved through an existing system of modular storage design. No health and safety implications for paramedics were identified during the development and implementation of the revised CPG.

DISCUSSION

The process of prehospital clinical practice guideline development has evolved to encompass evidence based principles, and yet from this example it can be seen that there is still much to be achieved with regard to producing appropriate research which eliminates a reliance on consensus decisions. The absence of available literature and prehospital-specific research reflects continued challenges in prehospital guideline development, yet provides an insight into those subjects which require investigation through research.

As the CPDG is tasked with evaluating often limited or absent evidence, this highlights an important role for the committee in identifying these gaps and prioritising the need to AV and other research bodies. Addressing these gaps will over time improve the quality of the process;

Supraventricular Tachyarrhythmias (SVT)

CPG A0403

Figure 4: The new AV CPG A0403 (Supraventricular tachycardia) Copyright: Ambulance Victoria

However, the mechanisms required to address the conduct of such research is outside the mandate of the CPDG.

At this time in Victoria, prehospital research is largely conducted within the AV Research Department, through post graduate studies by individuals, through small grants being offered by organisations and universities, and by paramedic students and staff from a number of universities which facilitate these programs. It is important that the future of clinical practice development includes a method of linking the efforts of the universities and the service providers to coordinate and focus research as it is needed. AV has implemented a process of CPG development which is compliant with major guideline development body recommendations, and yet within the example given it is clear that consensus decisions are still relied upon in the absence of evidence. The development and quality of such evidence is ongoing, and the results will influence CPG development over the next decade. Of importance is the movement of prehospital service providers to recognize the need for evidence based CPG development, and to have in place a framework for this development

in order that the evidence will be able to be utilised appropriately as it is derived from practice.

CONCLUSION

The development and implementation of new clinical guidelines in Victoria has evolved to embrace evidence based practice. The new SVT CPG (A0403) provides an example of how the AV CPD process can deliver evidence based guidelines using accepted development tools (such as AGREE) tailored to the prehospital care setting. The paucity of available prehospital-specific evidence means that consensus is still relied upon to complete the process, yet the evolution of further research will help to reduce reliance on this aspect and improve the quality and effectiveness of the process.

CONFLICT OF INTEREST

The authors declare they have no conflict of interest.

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