การศึกษาเปรียบเทียบคุณภาพการกดหน้าอกด้วยเท้ากับการกดหน้าอกด้วยมือในกลุ่มตัวอย่างเด็กนักเรียนชั้นมัธยมศึกษาตอนต้น : การศึกษาข้ามกลุ่มแบบสุ่มในหุ่นทดลอง

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บทคัดย่อ

บทนำ

การช่วยกู้ชีพผู้ป่วยที่เกิดภาวะหัวใจหยุดเต้นนอกโรงพยาบาลโดยผู้พบเห็นเหตุการณ์สามารถเพิ่มโอกาสการรอดชีวิตให้แก่ผู้ป่วยได้ แต่ในกรณีที่ผู้พบเห็นเหตุการณ์เป็นเด็กอาจจะมีน้ำหนักตัวที่น้อยหรือเกิดความเหนื่อยล้าได้มากกว่าผู้ใหญ่ปัจจุบันได้มีการศึกษาว่าการกดหน้าอกด้วยเท้ามีประสิทธิภาพไม่ต่างจากการกดหน้าอกด้วยมือในผู้ใหญ่ สามารถใช้ได้ในสถานการณ์พิเศษ แต่การศึกษาการกดหน้าอกด้วยเท้าในเด็กยังมีจำนวนน้อย ยังไม่มีข้อสรุปชัดเจนว่าในสถานการณ์ที่ผู้พบเห็นเหตุการณ์เป็นเด็กหรือมีน้ำหนักตัวน้อย การใช้เท้ากดหน้าอกจะมีผลต่อการกดหน้าอกอย่างมีประสิทธิภาพหรือไม่

วัตถุประสงค์

วัตถุประสงค์หลัก คือ เพื่อศึกษาประสิทธิภาพในการกดหน้าอกด้วยเท้าเปรียบเทียบกับการกดหน้าอกด้วยมือตามวิธีการมาตรฐานในกลุ่มเด็กนักเรียนที่มีอายุน้อยกว่า 15 ปี วัตถุประสงค์รอง คือ เพื่อศึกษาความสัมพันธ์ระหว่างน้ำหนักตัวของผู้กดหน้าอกกับประสิทธิภาพของการกดหน้าอกทั้งวิธีการกดหน้าอกด้วยเท้าและการกดหน้าอกด้วยมือ

วิธีการศึกษา

งานวิจัยแบบการทดลองชนิดCrossoverจัดทำระหว่างเดือนมกราคมถึงตุลาคม 2566 มีผู้เข้าร่วมงานวิจัยเป็นนักเรียนชั้นมัธยมศึกษาตอนต้น อายุ 13-15 ปี จำนวน 44 คน ใช้หุ่นCPR Training Manikins ในการเก็บข้อมูล 3 อย่าง ได้แก่ 1) อัตราการกดหน้าอก 2) ค่าเฉลี่ยความลึกในการกดหน้าอก 3) ร้อยละของการขยายตัวกลับของทรวงอกในระยะเวลา 2 นาที โดยให้นักเรียนผู้เข้าร่วมงานวิจัยจับฉลากแล้วแบ่งเป็นสองกลุ่มย่อย แต่ละกลุ่มจะทำการกดหน้าอกด้วยวิธีที่ต่างกันเป็นเวลา 2 นาที จากนั้นพัก 10 นาที แล้วเปลี่ยนวิธีการกดหน้าอกและทำซ้ำอีก 2 นาที

ผลการศึกษา

อัตราเร็วในการกดหน้าอกด้วยมือเร็วกว่าการกดด้วยเท้า 11.3±14.2 ครั้งต่อนาที (P<0.001) ส่วนความลึกในการกดหน้าอกมีค่าเฉลี่ยของการกดด้วยเท้าลึกกว่าการกดด้วยมือ -14.7±7.4 มิลลิเมตร (P<0.001) และการกดหน้าอกด้วยมือมีร้อยละการคืนตัวของทรวงอกสูงกว่าการกดหน้าอกด้วยเท้า อยู่ที่ร้อยละ 26.2±23.9 (P<0.001)

สรุปผลการศึกษา

ในเด็กนักเรียนอายุ 13-15 ปี การกดหน้าอกด้วยเท้ามีข้อได้เปรียบการกดหน้าอกด้วยมือในด้านความลึกของการกดหน้าอก อย่างไรก็ตาม การกดหน้าอกด้วยมือยังมีอัตราเร็วของการกดหน้าอกและร้อยละการขยายตัวกลับของหน้าอกที่ตรงตามมาตรฐานมากกว่าการกดหน้าอกด้วยเท้า ส่วนน้ำหนักของผู้กดหน้าอกไม่มีผลต่อประสิทธิภาพในการหน้าอกโดยภาพรวม

คำสำคัญ

การกู้ชีพ, การกดหน้าอกด้วยฝ่าเท้า, การทดลองในหุ่นทดลอง, เด็กนักเรียน

Comparison between Quality of Chest Compression by Foot and Hand in Middle School Children: A Randomized, Crossover Manikin Study

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Abstract

Introduction

Cardiopulmonary resuscitation (CPR) by a bystander can increase the survival rate of patients experiencing out-of-hospital cardiac arrest (OHCA). However, performing high-quality CPR using the standard hand-only technique may not be possible in cases where the bystander is a child. In special situations, it has been found that using the foot for chest compressions is equally effective as using the hand in adults. However, the effectiveness of this method when the bystander is a child is under-researched. Thus, we aimed to investigate the efficacy of chest compressions performed using a foot compared to those performed using a hand in children under 15 years of age. The investigation focused on three key parameters: 1) compression rate, 2) compression depth, 3) percentage of full chest recoil over two minutes.

Method

This crossover randomized controlled trial study was conducted between January and October 2023. We recruited 44 student participants aged 13-15 years. The participants used CPR Training Manikins with feedback data. Methods of chest compressions were assigned by simple random sampling, and after two minutes, the participants switched to the alternative method.

Results

Compression rate by hand exceeded by foot (11.3±14.2 bpm, P<0.001), while the percentage of full chest recoil by hand surpassed that during foot compressions (26.2±23.9%, P<0.001). Conversely, compression depth by foot was greater than by hand (-14.7±7.4 mm, P<0.001).

Conclusion

In school-aged children, chest compressions using a foot have an advantage in compression depth compared to hand compression. However, manual chest compressions maintain a faster compression rate and a higher percentage of chest recoil, aligning with established standards. The weight of the chest compressor does not significantly impact the overall efficiency of chest compressions.

Keywords

Cardiopulmonary resuscitation, Chest compression by foot, Manikin study, School-aged children

Introduction

In situations where a patient experiences out-of-hospital cardiac arrest (OHCA), cardiopulmonary resuscitation (CPR) by bystanders at the scene can increase patients' survival rate[1-2].Still, in some situations, the bystanders are unable to perform manual chest compression, which is a standard method, because of their physical limitations.The bystander who is a child or has a low body weight causes the chest compression to be less effective than desired[3-4], especially in chest compression depth[5-6].This will reduce the patient's chance of survival.

Currently, research is being conducted to find a new method of chest compressions that can improve the effectiveness of chest compressions in special situations where bystanders cannot use their hands to perform effective chest compressions. A method studied to be as effective as manual chest compressions in adults is chest compression using the foot[7-13]. However, only a few studies have been conducted about chest compressions using the foot in child bystanders[14], making it unclear whether foot compressions will improve the effectiveness of chest compressions in child bystanders.

Objectives

Primary objectives

To investigate the effectiveness of chest compressions using the foot compared to the hand in school-aged children under 15 years. Including: 1. Compression rate 2. Compression depth 3. Percentage of full chest recoil over two minutes.

Secondary objectives

To study the relationship between body weight and the effectiveness of chest compressions, using both foot and hand methods.

Method

Study design

A crossover randomized controlled trial was conducted between January and October 2023. It involved participants who were students in the early secondary levels of a selected school in Chonburi province. The total number of participants was 44, and the selection criteria for inclusion in this study were as follows: studying in grades 7-9 of the selected school in the Si Racha district, aged between 13-15 years. Exclusion criteria include individuals with chronic illnesses such as heart and vascular diseases, asthma, or blood disorders, pregnant persons, or those with physical limitations. Participants who willingly consented to participate in the study signed the informed consent document, and parental consent was obtained for each participant, ensuring full compliance with ethical guidelines and protocols.

Research ethics

This research has been approvedby the Research and Ethics Committee Queen Savang Vadhana Memorial Hospital with project number IRB 009/2566.

Research tools

The research utilized Resusci Anne® QCPR Training Manikins with SimPad SkillReporter that provide feedback on the following parameters:

1. Compression depth (measured in millimeters, mm)
2. Compression rate (measured in beats per minute, bpm)
3. Percentage of full chest recoil (%)

Data collection

The steps are shown in the study flow diagram (Figure 1).

1. The participants were instructed on hand and foot placement on the chest[12] and shown how to perform chest compressions through video clips. Each participant then practiced chest compressions on the training manikin two times for one minute per method.
2. Participants were randomized into two equal subgroups by drawing a number 1 or 2. Group 1 started with manual chest compressions, and Group 2 initiated with foot compressions.
3. Participants' vital signs were measured, including blood pressure, heart rate, and respiratory rate, before and after every round of chest compressions.
4. Each group performed chest compressions on the assigned manikin, which can record chest compression data for a 2-minute interval.
5. After completing two minutes, participants were given a 10-minute rest and then switched groups.The group that started using hands switched to using feet, and the other vice versa.
6. Each group performed chest compressions on the manikin using the assigned method for another two minutes.
7. Recorded data from both hand and foot compressions were collected and analyzed for each participant and each group.

Data analysis

Data underwent statistical analysis using IBM SPSS Statistics, version 28, and Stata software, version 14. General data was analyzed using descriptive statistics, presenting measures such as mean (Frequency), percentage, mean (Mean),and standard deviation (SD). For parametric statistical hypothesis testing, the Paired T-test was used. The significance level for hypothesis testing was set at 0.05.

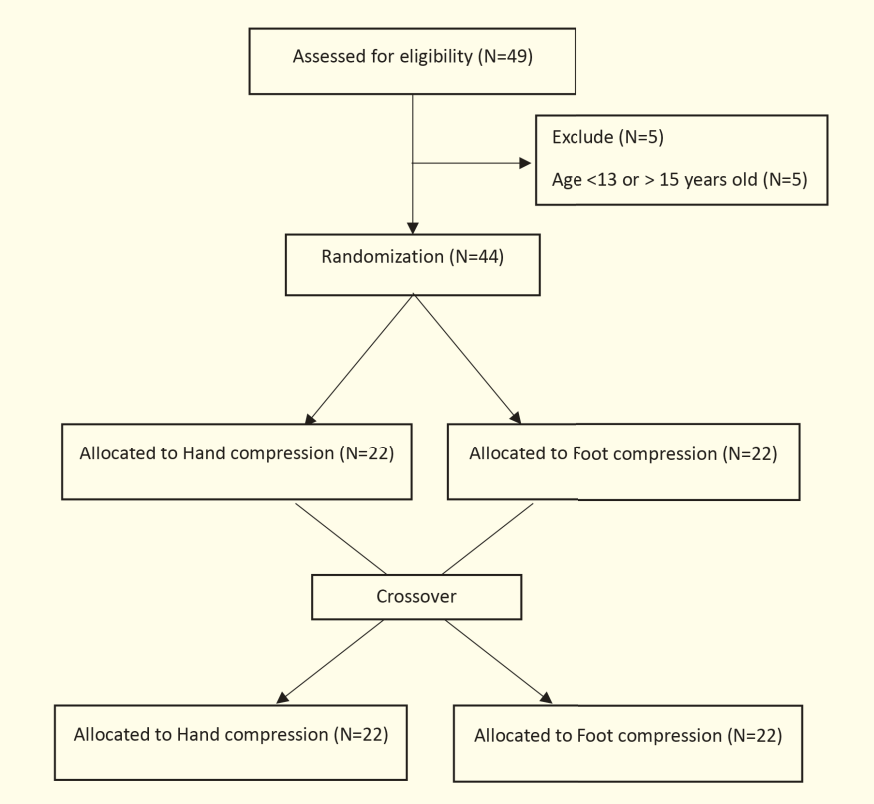

Figure 1 Study flow diagram

Results

Table 1 Baseline characteristics

Characteristics	Total (n=44) (%)
Gender	
Male	18 (40.9)
Female	26 (59.1)
Age (year) : Mean±SD	13.95±0.7
13	12 (27.3)
14	22 (50.0)
15	10 (22.7)
Height (centimeters) : Mean±SD	160.17±6.7
Weight (kilograms) : Mean±SD	50.89±12.4
<50	27 (61.4)
>50	17 (38.6)

The study included 44 participants, 40.9% male and 59.1% female. The average age was 13.95±0.71 years. The average height was 160.2±6.7 centimeters. The average weight was 50.9±12.4 kilograms.

Participants were further categorized based on weight:

1. Those weighing below 50 kilograms comprised 61% (n=27) of participants.

2. Those weighing 50 kilograms constituted 39% (n=17) of participants. As shown in Table 1

The study's results in comparing compression rates between hand and foot compressions are presented in Table 2. It was found that the average chest compression rate by hand was 109.4±11.3 bpm, while the average chest compression rate by foot was 98.1±9.2 bpm.The average difference between the two groups was 11.3±14.2 bpm (P<0.001).

Upon further analysis, we found that hand compressions had a higher average compression rate than foot compressions

Table 2 Comparison of compression rate between hand and foot compression and the relationship between the participant's body weight and compression rate of both hand and foot compression.

Total (n=44)	Mean compression rate* (SD)	95% CI	p-value
Compression by hand	109.41 (11.32)	105.97-112.85	
Compression by foot	98.09 (9.18)	95.30-100.88	
Compression rate difference	11.3 (14.16)	7.01-15.62	<0.001
Body weight <50 kg (n=27)	**Mean compression rate (SD)**	**95% CI**	**p-value**
Compression by hand	109.04 (11.32)	105.08-112.99	
Compression by foot	99.63 (9.18)	96.12-103.14	
Compression rate difference	9.41 (14.16)	4.92-13.89	<0.001
Body weight ≥50 kg (n=17)	**Mean compression rate (SD)**	**95% CI**	**p-value**
Compression by hand	110.00 (13.46)	103.08-116.92	
Compression by foot	95.65 (9.37)	90.83-100.47	
Compression rate difference	14.35 (17.72)	5.24-23.47	0.004

*Mean compression rate (measured in bpm)

Table 3 Comparison of compression depth between hand and foot compression and the relationship between the participant's body weight and depth of both hand and foot compression.

Total (n=44)	Mean compression depth* (SD)	95% CI	p-value
Compression by hand	25.32 (4.41)	23.98-26.66	
Compression by foot	40.05 (8.68)	37.41-42.68	
Compression depth difference	-14.73 (7.36)	-16.96- -12.49	<0.001
Body weight <50 kg (n=27)	**Mean compression depth (SD)**	**95% CI**	**p-value**
Compression by hand	23.11 (3.67)	21.66-24.56	
Compression by foot	35.67 (6.21)	33.21-38.12	
Compression depth difference	-12.56 (6.05)	-14.95- -10.16	<0.001
Body weight ≥50 kg (n=17)	**Mean compression depth (SD)**	**95% CI**	**p-value**
Compression by hand	28.82 (3.03)	27.27-30.38	
Compression by foot	47.00 (7.49)	43.15-50.85	
Compression depth difference	-18.18 (8.08)	-22.33- -14.02	<0.001

*Mean compression depth (measured in compression mm)

in both weight groups (below 50 kilograms and above 50 kilograms). Specifically, the mean difference was greater than 9.4±11.3 bpm (P<0.001) for the group with weight below 50 kilograms and greater than 14.4±17.7 bpm (P=0.004) for the group with weight above 50 kilograms. It shows no correlation between the participant's body weight and the effectiveness of chest compression in terms of compression rate.

Table 3 presents the results of a study comparing the chest compression depth between hand and foot compressions. It was found that the average chest compression depth by using the hand was 22.3±4.4 mm. The mean compression depth using the foot was 40.0±8.7 mm. The mean difference between the two groups was -14.7±7.4 mm (P<0.001).

Analysis of the difference between hand and foot compressions based on participants' body weight in the group weighing less than 50 kilograms shows significantly shallower compression depth with hand compression compared to foot compression, with a mean difference of

-12.6±6.1 mm (P<0.001). Similarly, hand compression shows a shallower compression depth in the group weighing more than 50 kilograms compared to foot compressions, with a mean difference of -18.2±8.1 millimeters (P<0.001). Demonstrating there is no relationship between the body weight of both groups and the effectiveness of chest compression in terms of compression depth.

The results of the study comparing the percentage of chest recoil in chest compression between hand and foot compressions are presented in Table 4. It was found that chest compression by hand has an average percentage of full chest

Table 4. Comparison of the percentage of full chest recoil between hand and foot compression and the relationship between the participant's body weight and percentage of full chest recoil of both hand compression and foot compression.

Total (n=44)	Mean percentage of full chest recoil*(SD)	95% CI	p-value
Compression by hand	99.48 (2.15)	98.82-100.13	
Compression by foot	73.30 (23.45)	66.17-80.43	
Full chest recoil percentage difference	26.18 (23.89)	18.92-33.45	<0.001
Body weight <50 kg (n=27)	**Mean percentage of full chest recoil (SD)**	**95% CI**	**p-value**
Compression by hand	99.74 (1.16)	99.28-100.20	
Compression by foot	79.96 (20.47)	71.87-88.06	
Full chest recoil percentage difference	19.78 (20.65)	11.61-27.95	<0.001
Body weight ≥50 kg (n=17)	**Mean percentage of full chest recoil (SD)**	**95% CI**	**p-value**
Compression by hand	99.06 (3.15)	97.44-100.68	
Compression by foot	62.71 (24.56)	50.08-75.33	
Full chest recoil percentage difference	36.35 (25.73)	23.12-49.58	<0.001

*Mean percentage of full chest recoil (%)

recoil at 99.5±2.2%. The mean percentage of full chest recoil by foot compressions was 73.3±23.5%. The average difference between the two groups was 26.2±23.9% (P<0.001).

Analyzing the differences in the mean of chest recoil percentage using hand and foot compressions in the group weighing below 50 kilograms found that hand compression has a greater average percentage of chest recoil when compared with chest compressions using foot at 19.8±20.7% (P<0.001). While the difference among people weighing more than 50 kilograms is36.4±25.7% (P<0.001). It indicates no relationship between the participant's body weight and the effectiveness of chest compressions in terms of the percentage of chest recoil.

Discussion

This study demonstrated that manual chest compressions in children aged 13-15 can provide an appropriate chest compression rate of 109.4±11.3 bpm, and the percentage of full chest recoil is 99.5±2.2%. In contrast, foot compression had a slightly lower chest compression rate (98.1±9.2 bpm) and a lower percentage of full chest recoil of 73.3±23.5%. Statistical analysis revealed significant differences in both compression rate (p<0.001) and chest recoil percentage (p<0.001) between the two methods. However, while foot compressions showed statistically significant differences, the study found that the mean depth of foot compressions (40.0±8.7 mm). At the same time, hand compressions resulted in a shallower depth (22.3±4.4 mm) with a significant difference (p<0.001). Consistent with the 2020 American Heart Association (AHA) Guideline for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care[15] that states high-quality CPR should include minimizing interruptions in chest compressions, adequate compression rate (100-120/min) and compression depth (5-6 centimeters), avoiding leaning on the chest and avoiding excessive ventilation.

When analyzed by the participant's body weight, both the group weighing below 50 kilograms and the group weighing exceeding 50 kilograms provided the same results in the compression rate and percentage of full chest recoil. That is, chest compression by hand in both groups was greater than foot compressions. However, chest compression depth using foot yields results closer to the predefined AHA value[15] (5-6 cm) than manual chest compressions in both groups, especially in groups weighing more than 50 kilograms. From the results in Tables 2-4, it can be concluded that the participant's body

weight is not related to the effectiveness of chest compression in either method of chest compressions. For both those who weigh under and over 50 kilograms, chest compressions by hand are more effective than foot compressions based on the standards set by the AHA[15].

From the previous study of Otero-Agra[11], our study can be consistent with the result that using the hand in chest compress is better than using the foot. However, using the foot to compress the chest has an efficiency close to the standard in terms of compression depth and rate. Therefore, it may be used in place of manual chest compressions if necessary. Moreover, our study is consistent with the Takahashi[12] study in adults, showing that the depth of chest compression was more significant than that using foot compressions. However, The results of this study provide contradictory findings to Kherbeche[14], who compared the effectiveness of hand and foot compressions in school children. It was found that using feet produced a lower compression depth than using hands when performing chest compressions.

This study used manikins; no studies have been conducted on actual patients, so the results in actual patients may differ. From all the results of this study, it can be evident that manual chest compressions remain the standard method recommended for most patients. Chest compressions by foot should be considered only in specific circumstances and cannot be used as a substitute for manual chest compressions.

Suggestion

We collected data about the effectiveness of chest compressions reported by the SimPad SkillReporter but did not record participants' foot location on the manikin during the experiment. This makes it impossible to tell the accuracy of the area where chest compressions are received. We recommend that additional studies be conducted to examine the accuracy of foot placement in chest compression compared to the accuracy of hand placement.

Additionally, a study used a footstool during chest compressions[12] to compare with manual and foot-standing compressions. It was found that standing on a footstool during chest compressions increases the depth of foot compressions. However, no study has examined the percentage of chest recoil, and a footstool has not been used in any study about chest compressions by child bystanders. Therefore, we recommend using a footstool in future studies to see the effectiveness of the percentage of chest recoil compared to

manual chest compressions.

Conclusion

Manual chest compressions in students aged 13-15 can provide a higher compression rate and a better percentage of full chest expansion than foot compressions, providing results as set by the AHA for High-quality CPR[15], while compression using foot has an advantage in compression depth compared to hand.

The participant's body weight was not related to the effectiveness of chest compressions. The results of chest compressions using hand and foot in both groups are the same. The compression rate and percentage of full chest expansion are better in manual chest compressions, but compression by foot made a better compression depth.

Nevertheless, while manual chest compressions remain the standard according to AHA guidelines, foot compressions may be applicable in some specific situations.

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Conflict of interest

The authors declare no conflicts of interest.

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References

1. Yan S, Gan Y, Jiang N, Wang R, Chen Y, Luo Z, et al. The global survival rate among adult out-of-hospital cardiac arrest patients who received cardiopulmonary resuscitation: a systematic review and meta-analysis. Crit Care 2020;24(1).
2. Hasegawa T, Daikoku R, Saito S, Saito Y. Relationship between weight of rescuer and quality of chest compression during cardiopulmonary resuscitation. J Phys Anthropol 2014;33(1).
3. Holmberg M, Holmberg S, Herlitz J. Effect of bystander cardiopulmonary resuscitation in out-of-hospital cardiac arrest patients in Sweden. Resuscitation 2000;47(1):59–70.
4. Ashton A, McCluskey A, Gwinnutt CL, Keenan AM. Effect of rescuer fatigue on performance of continuous external chest compressions over 3 min. Resuscitation 2002;55(2):151–5.
5. Oh JH, Kim CW. Relationship between chest compression depth and novice rescuer body

weight during cardiopulmonary resuscitation. Am J Emerg Med2016;34(12): 2411–3.
6. Roh YS, Lim EJ. Factors influencing quality of chest compression depth in nursing stu¬dents. IntJ Nurs Pract 2013;19(6):591–5.
7. Bilfield LH, Regula GA. A new technique for external heart compression. JAMA1978; 239:2468–9
8. Donegan J. The leg-heel vs the standard arm-hand method of external cardiac compression. Anesth Analg 1979;58:170–3.
9. Sefrin P, Albert M. External heart compression with the heel (author'stransl). Anaesthesist 1979;28:540–45.
10. Ott M, Krohn A, Bilfield LH, Dengler F, Jaki C, Echterdiek F, et al. Leg-heel chest compression as an alternative for medical professionals in times of COVID-19. Am JEmerg Med 2021;50:575–81.
11. Otero-Agra M, Santiago-Urgal N, Hermo-Gonzalo MT, Fernández-Méndez M, Fernández-Méndez F. CPR by foot. An alternative in special circumstances? A randomized simulation study. Am J Emerg Med 2021;43:1–6.
12. Takahashi Y, Saitoh T, Okada M, Satoh H, Akai T, Mochizuki T, et al. The potential of leg-foot chest compression as an alternative to conventional hands-on compression during cardiopulmonary resuscitation. Hong Kong J Emerg Med 2018;26(2):106–10.
13. Trenkamp RH, Perez FJ. Heel compressions quadruple the number of bystanders who can perform chest compressions for 10 minutes. Am J Emerg Med 2015;33(10): 1449–53.
14. Kherbeche H, Exer N, Schuhwerk W, Ummenhofer W, Osterwalder J. Chest compression using the foot or hand method: a prospective, randomized, controlled manikin study with school children. Eur J Emerg Med 2017;24(4):262–7.
15. Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG, et al. Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2020;142(16suppl 2).S366-S468.