Recent Research in Science and Technology 2010, 2(5): 136-143
ISSN: 2076-5061
www.recent-science.com

MEDICAL SCIENCES

A RANDOMISED CLINICAL TRIAL TO COMPARE THE POST DURAL PUNCTURE HEADACHE FOLLOWING SPINAL ANAESTHESIA USING 27 G QUINCKE'S AND 27 G WHITACRE'S SPINAL NEEDLES

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Abstract

Background and objectives

Spinal anaesthesia is one of the most commonly used techniques in anaesthesia. It is economical, safe, cost effective, easy, needs less sophisticated anaesthetic equipment, drugs, post operative care hence preferred over general anaesthesia and most popular because of its profound analgesia and muscle relaxation. Objectives of the present study were to know the incidence of post dural puncture headache (PDPH), number of attempts for successful sub arachnoid block and incidence of failed spinal anaesthesia by using 27 G Quincke's and Whitacre's spinal needles.

Methodology

This one year randomized clinical trial was conducted in the Department of Anaesthesiology, at our hospital during the period of January 2009 to December 2009 on 352 patients between 20 to 60 years of age with ASA grade I and II undergoing lower abdominal and lower limb surgeries during the study period. The Institutional Ethical Clearance and written informed consent from patients was obtained the incidence of PDPH, number attempts and failed spinal anaesthesia were assessed.

Results

In this study female preponderance was seen. Significantly high incidence of PDPH was recorded in Quincke group (3.98%) as compared to 0.57% in Whitacre group (p=0.031). Significantly less number of attempts were required using Whitacre 27 G needle (p=0.0001). Failed rates were higher in patients using Whitacre 27 G needle as compared Quincke 27 G needle (3.98% versus 2.84%).

Interpretation and conclusion

Overall the Whitacre 27 G needle has better results with respect to PDPH and number of attempts required for successful subarachnoid block whereas the incidence of failed spinal anaesthesia was less with Quincke 27 G needle.

Keywords: Post dural puncture headache; Failed spinal anaesthesia; Sub-arachnoid block; Quincke needle; Whitacre needle

Introduction

Pain is the most dramatic, complex and universal phenomenon, perhaps the only sensation which is well understood by mankind. It is an unpleasant sensation which only the individual can appreciate. To quote Hippocrates, "Divine is the task to relieve pain." The International Association for study of pain has defined "A conscious sensation of distress, suffering or agony with actual or at least potential tissue damage".[1]

An essential part of the anaesthesiologists work is rendering the patient insensitive to pain. The control centre is regulated by the brain which receives information through the spinal cord and specialised sensory cells. Spinal anaesthesia act by temporary interruption of transmission of nerve impulses produced by injection of a local anaesthetic agent into subarachnoid space. It is one of the most commonly used anaesthesia technique for lower extremity and lower abdominal surgeries.[2] It is economical, safe, easy technique and is preferred over general anaesthesia (GA).[2] It was discovered by J. Leonard Corning in 1885, a neurologist from New York – he accidentally pierced the dura and injected cocaine to produce spinal analgesia in dog. He concluded that if "cocaine was injected in between the two spinous processes, it would be absorbed by veins causing sensory and motor blockade".[3]

August Bier first used it deliberately in 16th August 1898 with three ml of 0.5% cocaine. On 24th August, he was administered spinal anaesthesia by his assistant. During the attempt, a lot of cerebrospinal fluid (CSF) was lost and Bier developed post dural puncture headache (PDPH) and this was the first documented case of PDPH.[4] Since then it has passed through phases, characterized by overly enthusiastic acceptance followed by phases of rejection. Spinal anaesthesia has become popular because it results in good sympathetic blockade, sensory analgesia, profound muscle relaxation and less operative blood loss. However, the fear of precipitating PDPH after spinal anaesthesia currently limits the use since the

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incidence of this complication is directly related to gauges (G) and types of needle. Various gauges and tips have been devised to reduce the incidence of PDPH. The newly introduced Whitacre needle is associated with lesser incidence of PDPH.[5]

To combat these side effects, various attempts have been made to change the size and design of the needle. Trials comparing non-cutting (Whitacre's, pencil point) with cutting needles (Quincke's) to decrease PDPH have also been tried out.[6,7,8] There are very few studies reported in the literature comparing the incidence of PDPH using 27 G Quincke's and 27 G Whitacre's needles. Hence the present study was an attempt to compare these two needles with respect to the incidence of PDPH as well as the number of attempts required to administer successful subarachnoid block (SAB).

Objectives

Objectives of the present study were to evaluate the following parameters on using 27 G Quincke's and Whitacre's spinal needles. Primary objective:To know the incidence of PDPH. Secondary objective:To know the number of attempts for successful SAB and incidence of failed spinal anaesthesia.

Methodology

The present study was conducted in the Department of Anaesthesiology, at our hospital during the period of January 2009 to December 2009. Patients between 20 to 60 years of age with ASA grade I and II undergoing lower abdobinal and lower limb surgeries during the study period at our hospital.

Sample Size and sampling procedure

176 patients are selected in each group based on the following calculation.

$$\text{Sample Size} = \frac{2 \times (Z\alpha + Z\beta)^2 \times p \times q}{d^2}$$

$$= \frac{2 \times (1.96 + 0.84)^2 \times 8.5 \times 91.5}{8 \times 8}$$

$$= 176$$

Randomization procedure

Based on the above calculation a total of 352 patients are allocated randomly into group A and group B by using a computer generated randomization table.

Selection Criteria

Inclusion criteria: Patients undergoing lower abdominal surgeries, Patients undergoing lowerlimb surgeries, Age between 20 to 60 years, No clinically significant cardiovascular, respiratory and central nervous system disease (ASA Grade I and II).

Exclusion criteria: Patient refusal, Allergy to Bupivacaine, History of bleeding diathesis, Severe to moderate hypotension, Arrhythmias, Infection at the site of spinal needle insertion, Severe spinal abnormalities like spina bifida, meningocele, Raised intracranial tension, hydrocephalus.

Procedure

The study was approved and ethical clearance was obtained from Human Ethics Committee, of our college. After finding the suitability according to selection criteria patients were selected for the study and briefed about the nature of the study, the interventions used and written informed consent was obtained. Further, descriptive data of the patients like name, age, sex, detailed history, were obtained and recorded on predesigned and pretested proforma.

Pre-anaesthetic evaluation

A thorough pre-anaesthetic evaluation was performed by taking history and clinical examination. In all the patients, height, weight, basal heart rate, respiratory rate and blood pressure were measured and recorded. Investigations like complete blood count, urine for albumin, sugar and microscopy were done. Blood sugar, electrocardiogram and chest x-ray were performed.

Anaesthesia procedure

Intravenous (IV) line was secured using 18 G cannula. All patients were preloaded with 500 ml of ringer lactate solution. Electrocardiograms (ECG), non-invasive blood pressure (NIBP), oxygen saturation (SPO2) were monitored. Patients of ASA I - II aged 20 to 60 yrs undergoing lower abdominal and lower limb surgeries were taken. Patients were allocated into group A and group B by computer generated randomisation table. Group A patients received spinal anaesthesia with 27 G Quincke's spinal needle and Group B received spinal anaesthesia with 27 G Whitacre's spinal needle. Under strict aseptic precautions, using midline approach 27 G Quincke's or 27 G Whitacre's spinal needle inserted into L_3–L_4, sub arachnoid space. Three ml of 0.5% heavy bupivacaine injected after confirming for free flow of CSF. Experienced anaesthesiologists performed the blocks. Failure of spinal anaesthesia was defined as either inability to elicit free flow of CSF after three attempts or clearly inadequate analgesia for surgery at 15 minutes after giving local anaesthetic. The number of attempts of dural puncture and the presence or absence of tactile identification, usually described as a click phenomenon on dural puncture.

Heart rates (HR), NIBP, SPO2 were recorded every three minutes for 15 minutes, then every five minutes for 30 minutes and thereafter every 10 minutes.

All patients were seen on the day of surgery and every day for three days. They were questioned about postdural puncture headache or were contacted by telephone if discharged early. Criteria for post dural puncture headache was; Onset after spinal anaesthesia within 48 to 72 hours, Mostly located to occipital or frontal region, Aggravated by erect or sitting position, coughing and straining, Relieved by lying flat.

PDPH assessed on the basis of standard numeric analog scale (NAS) 0-100.

1. Mild (0-33) when sitting or ambulating.
2. Moderate (34-66) when sitting.
3. Severe (67-100) when supine.

Statistical analysis

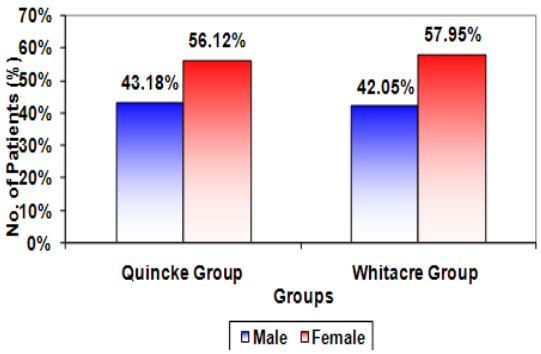
The data obtained was tabulated and analysed for rates, ratios and percentages. The test of proportion was used for incidence of PDPH and Chi square test was applied for number of attempts and failed spinal anaesthesia.

Results

Table No. 2. Sex distribution

Gender	Quincke group		Whitacre Group	
	Number	Percentage	Number	Percentage
Male	76	43.18%	74	42.05%
Female	100	56.12%	102	57.95%
Total	176	100%	176	100%

Graph 1: Sex distribution

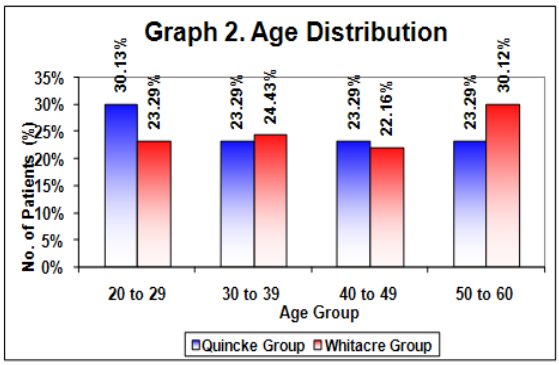


In this study females outnumbered males in both the groups (56.12% and 57.95%) with male to female ratio of 1:1.31 in Quincke group and 1:1.37 in Whitacre group.

Table No. 3. Age distribution

Age (Years)	Quincke group		Whitacre Group	
	Number	Percentage	Number	Percentage
20 to 29	53	30.13%	41	23.29%
30 to 39	41	23.29%	43	24.43%
40 to 49	41	23.29%	39	22.16%
50 to 60	41	23.29%	53	30.12%
Total	176	100%	176	100%

Graph 2: Age distribution

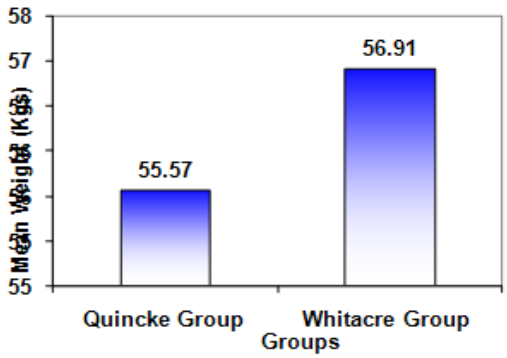


In the present study majority (30.13%) of the patients had age between 20 to 29 years in Quincke group compared to 30.12% of the patients in the age ranging from 50 to 60 years in Whitacre group. The mean age in Whitacre group was 40.74 ± 12.25 years whereas in Quincke group it was 38.58 ± 11.95 years.

Table No. 4. Mean Weight

	Quincke group		Whitacre Group	
	Mean	S.D.	Mean	S.D.
Weight	55.57	11.95	56.91	7.43

Graph 3: Mean weight



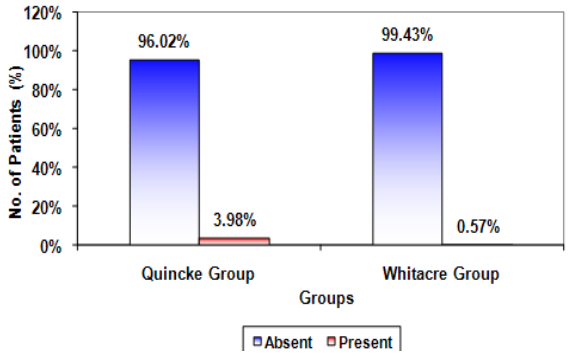
In this study the mean weight of the patients in Quincke group was 55.57 ± 11.95 kg whereas in Whitacre group it was 56.91 ± 7.43 Kg.

Table No. 5. Incidence of PDPH

Grade	Quincke group		Whitacre Group	
	Number	Percentage	Number	Percentage
Present	7	3.98%	1	0.57%
Absent	169	96.02%	175	99.43%
Total	176	100%	176	100%

p=0.0319 (Test of Proportion)

Graph 4: Incidence of PDPH



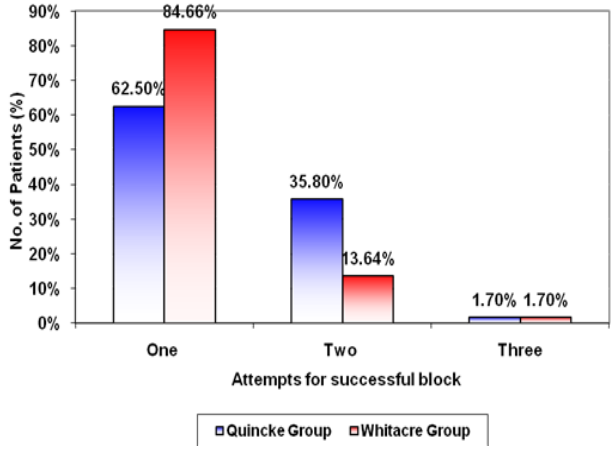
In the present study the 3.98% patients had PDPH in Quincke group and 0.57% patients in Whitacre group and this difference was statistically significant using test of proportion (p=0.031).

Table No. 6. Comparison of number of attempts for successful block

No. of attempts	Quincke group		Whitacre Group	
	Number	Percentage	Number	Percentage
One	110	62.5%	149	84.66%
Two	63	35.8%	24	13.64%
Three	03	1.70%	03	1.70%
Total	176	100%	176	100%

p=0.0001 (Chi square test)

Graph 5: Comparison of number of attempts for successful block



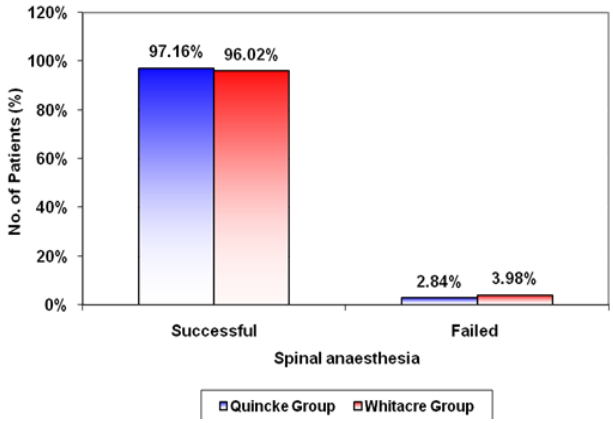
In the present study, 62.5% of the patients in Quicke group required one attempt, 35.80% required two attempts and 1.70% required three attempts for successful block. Whereas in Whitacre group 84.66%, 13.64% and 1.70% of the patients required one, two and three attempts respectively. When these values were compared using chi-square test significant association was recorded between the type of needle and number of attempts (p=0.0001).

Table No. 7. Incidence of failed spinal anaesthesia

Spinal anaesthesia	Quincke group		Whitacre Group	
	Number	Percentage	Number	Percentage
Successful	171	97.16%	169	96.02%
Failed	05	2.84%	07	3.98%
Total	176	100%	176	100%

p=0.557 (Chi Square Test)

Graph 6. Incidence of failed spinal anaesthesia



In the present study incidence of 2.84% failed spinal anaesthesia in Quincke Group and 3.98% in Whitacre Group was recorded. However, no statically significant association between the type of the needle and the number of failed spinal anaesthesia could be recorded (p=0.557).

Discussion

Spinal anaesthesia is one of the most commonly used technique in anaesthesia. It is economical, safe, easy and needs less sophisticated anaesthetic equipments, drugs, post operative care hence preferred over general anaesthesia and most popular because of its profound analgesia and muscle relaxation.[2]Loss of CSF from the punctured site produces low CSF pressure which in turn leads to intracranial venous dilatation resulting in an increase in brain volume in the upright position. There occurs a difference in CSF volume and also pressure difference between the intracranium and intravertebral part of the subarachnoid space. Venous dilation and compensatory increase in brain volume will result in brain sag which in turn will exert traction and stimulate pain sensitive anchoring structures like dural vessels, basal dura and tentorium cerebelli, causing post spinal headache.[9]

Pain arising from the tentorium cerebelli is transmitted by the fifth nerve and from the structures on or below the inferior surface of the tentorium is transmitted by the ninth, tenth cranial nerves and the upper cervical nerves. Post dural puncture headache due to low cerebrospinal fluid pressure is differentiated from other headaches as it aggravates on sitting, standing, moving around, coughing and straining. Inadequate intake of fluid and conditions causing loss of fluids such as diarrhoea, vomiting, haemorrhage, sweating and lactation tend to make the condition worse.[3]

August Bier first reported post dural puncture headache. Post dural puncture headache would be familiar to anyone in practice today. Needle tip configuration and needle size greatly influenced incidence of headache in patients.[10] One year randomized clinical trial was an attempt to compare role of two needles that is Quincke 27 G and Whitacre 27 G needles with respect to the incidence of PDPH as well as the number of attempts required to administer successful subarachnoid block (SAB). In the present study, 56.12% and 57.95% were females whereas 43.18% and 42.05% were males in Quincke and Whitacre groups respectively whereas, in a study[11] 108 were males and 91 were females in Quincke group and 116 were males and 83 were females in Whitacre group. Another study[12] reported male predominance that is 74 males and 23 females in Quincke group and 71 males and 26 females in Whitacre group. In this study the mean age in Quincke group was 38.58 ± 11.95 years whereas in Whitacre group it was 40.74 ± 12.25 years. A study[11] reported similar results that is, mean age of 37 ± 14 years in Quincke group and 36 ± 15 years in Whitacre group whereas, another study[12]

reported average age of 32.5 years in Quincke group and 31.7 years in Whitacre group. In the present study mean weight of the patients in Quincke group was 55.57 ± 11.95 kg whereas in Whitacre group it was 56.91 ± 7.43 Kg. Similar findings were reported by authors in a study[13] that is 52.8 ± 5.20 in Quincke group and 52.6 ± 6.10 in Whitacre group. Whereas another study[15] reported mean weight of 73 ± 12 Kg in Quincke group and 74 ± 13 Kg in Whitacre group.

There is considerable evidence that the PDPH is due to a low CSF pressure consequent upon seepage of CSF through the dural puncture hole, choroid plexus is unable to secrete sufficient fluid to maintain the CSF pressure. Moreover the negative pressure in the epidural space may draw CSF from subarachnoid space. Cerebro spinal fluid leakage from the punctured dural site produces loss of CSF pressure, which in turn leads to intracranial venous dilatation resulting in an increase in brain volume in the upright position. There occurs a difference in CSF volume and also pressure difference between the intracranial and intravertebral part of the subarachnoid space. Venous dilation and compensatory increase in brain volume will result in brain sag which in turn will exert traction and stimulate pain sensitive anchoring structures like dural vessels, basal dura and tentorium cerebelli, causing post spinal headache. Larger the hole in dura mater, more will be the leakage of CSF and longer the time required for repair. The number of holes in the dura also makes a difference in the loss of CSF. It takes about two weeks or more for the holes to seal.[9]

In this study the incidence of PDPH was 3.98% in Quincke group and 0.57% patients in Whitracre group and this difference was statistically significant using test of proportion (p=0.031). A study[15] conducted to assess failed spinal anaesthesia and PDPH in orthopedic patients using 27 G Whitacre and Quincke needles reported incidence of one percent in Quincke group and 0.5% in Whitacre group. The incidence of PDPH with the Quincke 27 gauge needle compares well with several other studies which report zero to four percent with highest occurrence in obstetric population. Whereas another study[12] conducted to assess PDPH after spinal anaesthesia in young orthopaedic patients reported higher incidence of PDPH in Quincke 27 G group compared to Whitacre 27 G group (10.3% versus 8.2%). A similar Indian study[9] conducted to assess PDPH in caesarean section using 27 G Whitacre and Quincke needles reports 12.5% incidence in 27 G Quincke and 4.5% in 27 G Whitacre. In the present study, 62.5% of the patients in Quincke group required one attempt, 35.80% required two attempts and 1.70% required three attempts for successful block. Whereas in Whitacre group 84.66%, 13.64% and 1.70% of the patients required one, two and three attempts respectively. When these values were compared using chi-square test significant association was recorded between the type of needle and number of attempts (p=0.0001). A study[11] conducted to assess failed spinal anaesthesia and PDPH in orthopedic patients using 27 G Whitacre and Quincke needles reported one attempt in 81% patients, two attempts in nine percent and three attempts in four percent among the patients with Quincke group and 82.5%, 9.5% and three percent patients in Whitacre group required one, two and three number of attempts for successful spinal anaesthesia. In the present study incidence of 2.84% failed spinal anaesthesia in Quincke Group and 3.98% in Whitacre Group was recorded. However, no statically significant association between the type of the needle and the number of failed spinal anaesthesia could be recorded (p=0.557). A similar Indian study[13] conducted to assess PDPH in caesarean section using 27 G Whitacre and Quincke needles reports four percent failure rate in 27 G Quincke group and 12% in 27 G Whitacre and these failure rates were not statistically significant. Whereas in another study[11] failure to achieve dural puncture was more common with Quincke group than with Whitacre needle (5.5% versus 3.5). This variation of failure rates may have attributed to the difference in tactile sensation on dural puncture. Another possible explanation may be that the appearance of CSF in Quincke needle hub is no guarantee of the needle bewel being completely within the subarachnoid space. Another possibility may be side port may straddle the dura causing leakage into the subdural or epidural space which is most commonly seen in Whitacre needles and as with all finer gauge needles, pain staking care is required to avoid dislodging the needle tip in subarachnoid space leading to loss of some local anaesthetic. To summarise the Whitacre 27 G needle has better results with respect to PDPH and number of attempts required for successful subarachnoid block whereas the incidence of failed spinal anaesthesia was less with Quincke 27 G needle. More studies need to be done in this regard to find out the effectiveness of these needles.

Conclusion

In the present study females were outnumbered males in both the groups. The mean age in Quincke group was 38.58 ± 11.95 years whereas in Whitacre group it was 40.74 ± 12.25 years. The mean weight of the patients in Quincke group was 55.57 ± 11.95 kg whereas in Whitacre group it was 56.91 ± 7.43 Kg. Significantly high incidence of PDPH was recorded in Quincke group (3.98%) as compared to 0.57% in Whitacre group (p=0.031). Significantly less number of attempts were required using Whitacre 27 G needle (p=0.0001). Failed rates were higher in patients using Whitacre 27 G needle as compared to Quincke 27 G needle (3.98% versus 2.84%).

Summary

Spinal anaesthesia is one of the most commonly used technique in anaesthesia. It is economical safe, cost effective, easy, needs less sophisticated anaesthetic equipment, drugs, post operative care hence preferred over general anaesthesia and most popular because of its profound analgesia and muscle relaxation. This one year randomized clinical trial was an attempt to compare role of two needles that is Quincke 27 G and Whitacre 27 G needles with respect to the incidence of PDPH as well as the number of attempts required to administer successful subarachnoid block (SAB). Objectives of the present study were to know the incidence of PDPH, number of attempts for successful SAB and incidence of failed spinal anaesthesia on using 27 G Quincke's and Whitacre's spinal needles. This study was conducted at our hospital on 352 patients between 20 to 60 years of age with ASA grade I and II undergoing lower abdominal and lower limb surgeries during the study period. In this study female preponderance was seen. Significantly high incidence of PDPH was recorded in Quincke group (3.98%) as compared to 0.57% in Whitacre group (p=0.031). Significantly less number of attempts were required using Whitacre 27 G needle (p=0.0001). Failed rates were higher in patients using Whitacre 27 G needle as compared Quincke 27 G needle (3.98% versus 2.84%). Overall the Whitacre 27 G needle has better results with respect to PDPH and number of attempts required for successful subarachnoid block whereas the incidence of failed spinal anaesthesia was less with Quincke 27 G needle.

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