MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.5.53.57

Comparative Evaluation of Well Score and Autar DVT Risk Assessment Scale to Predict the Risk of DVT in Surgical Patients

[1]Ashutosh Kumar and [2]M. Manjusha Litake

[1,2]Department of General Surgery, B.J. Medical College, Pune, Maharashtra, India

ABSTRACT

The aim of the present study was to compare the Well's score and Autar DVT risk assessment scale for risk assessment of DVT in patients admitted to all surgical wards. 500 Patients with lower extremity trauma patients who met the requirements for this study were assessed by both the Autar and Wells tools for DVT risk assessment during the first 24 hrs after their admission. Statistical analysis was performed using SPSS 18. Of 500 cases studied the most common age group involved was 31-40 with 109 cases (21.8%). Of 500 cases studied, 374 (74.8%) were males and 126 (25.2%) were females. Of 500 cases studied, 178 (35.6%) had pain, 125 (25.0%) had trauma, 106 (21.2%) had swelling of limbs, 56 (11.2%) had immobilization. Of 500 cases studied, 331 (66.2%) had normal Doppler study, 86 (17.2%) had DVT, 56 (11.2%) had PVD and 27 (5.4%) had venous incompetence. Of 500 cases studied, 488 (97.6%) had normal Chest X-ray findings, 8 (1.6%) had rib fracture, 1 (0.2%) had clavicle fracture, 1 (0.2%) had COPD, 1 (0.2%) had pleural effusion and 1 (0.2%) had lung collapse. Of 500 cases studied, 406 (81.2%) had Well's score between 0-1-94 (18.8%) had Well's score between 2-3. Of 500 cases studied, 462 (92.4%) had AUTAR's score less than or equal to 10-34 (6.8%) had AUTAR's score between 11-14 and 4 (0.8%) had AUTAR's score more than or equal to 15. The distribution of colour Doppler findings differs significantly across two groups of Well's score ($p<0.001$). Significantly higher proportion of cases with Well's score between 0-1 had normal colour doppler and significantly higher proportion of cases with Well's score between 2-3 had DVT on colour Doppler ($p<0.001$). DVT is a serious and critical clinical condition that causes severe morbidity and mortality which could be prevented. It is evident that early prediction of DVT can be done by using the Well's score, and hence, early preventive measures can be taken to avoid the occurrence of DVT and its related complications. Well's criteria, autar deep risk assessment scale, deep vein thrombosis, mortality, surgical patients.

OPEN ACCESS

Key Words

Well's criteria, autar deep risk assessment scale, deep vein thrombosis, mortality, surgical patients

Corresponding Author

Ashutosh Kumar,
Department of General Surgery, B.J. Medical College, Pune, Maharashtra, India

Received: 20 November 2023
Accepted: 31 December 2023
Published: 8 January 2024

Citation: Ashutosh Kumar and M. Manjusha Litake, 2024. Comparative Evaluation of Well Score and Autar DVT Risk Assessment Scale to Predict the Risk of DVT in Surgical Patients. Res. J. Med. Sci., 18: 53-57, doi: 10.59218/makrjms.2024.5.53.57

INTRODUCTION

Venous thromboembolism (VTE), comprising of deep vein thrombosis (DVT) and pulmonary embolism (PE) is the third leading cause of death in hospitalized trauma patients, with an estimated incidence of 5-20% with prophylaxis[1-3]. This wide range in incidence of VTE is attributed to variability in patient's risk factors, choice of prophylaxis and modalities of screening and detection of VTE[1-4]. Deep vein thrombosis is the most dangerous and silent killer in critical care areas it inhibits the recovery of the patient in ICU. The critical patient is often mixed with various dysfunction of the organ system which is shown in physiological changes in severe respiratory, cardiovascular and neurological derangement[5]. DVT is a vascular disease that occurred by forming it clot in veins due to that, blood supply inhibit the further process which started with symptoms like severe pain not being able to walk swelling in the legs either bilateral or unilateral person who are age more than 60 yrs and a person who got recent surgery within six years six months people who are not immobilized more than 72 hrs has a more chance of developing DVT[6].

The prevalence of DVT is reported to be approximately 100 per 100000 people per year)[7] although incidence increases with age and the incidence of both DVT and the DVT recurrence is higher in men than women[8-10]. DVT is also more common in Black and Hispanic people than Caucasians[11]. Depending on the various risk factors and clinical signs and symptoms various risk assessment scales for DVT have been proposed. Currently, screening is suggested for patients who are at high risk of developing DVT and have received sub-optimal or no thromboprophylaxis. Given this clinical dilemma, a means of increasing the pretest probability of screening algorithms is needed to optimize DVT detection and cost-effectiveness. Multiple tools are available to identify high-risk patients in the outpatient setting such as Wells Score, Geneva Score, Minaiti Score and Charlotte rule, of which the Wells score with its modification is the most widely used and accepted scoring system[12-14]. Well's score includes lower limb related symptoms such as swollen limb, immobilization, collateral superficial veins, pitting edema, localized tenderness and whether a patient has active cancer or not.

The Autar DVT scale (1994-1996 b) was developed to proactively identify patients at risk, so that the recommended prophylaxis could be promptly initiated. The Autar risk assessment scale includes age, BMI, current high risk diseases, trauma, mobility and whether a patient needs surgical intervention. A correlation coefficient ORÞ achieved a value of 0.94 confirming the consistency of the DVT risk calculator. Most patients assessed for DVT risk fell in the high risk category and choosing a cut-off score of 16, the DVT scale achieved 100% sensitivity and 81% specificity[15]. Hence the aim was to compare the Well's score and Autar DVT risk assessment scale for risk assessment of DVT in patients admitted to all surgical wards.

MATERIALS AND METHODS

500 patients admitted to the surgical wards of a tertiary care hospital during a period of December-May 2016-2018 were evaluated prospectively for the assessment of the risk of DVT development using two different scores.

Inclusion criteria:

- All patients above the age of 18 admitted to the surgical ward at a tertiary care hospital

Exclusion criteria:

- Age <18 yrs
- Pregnant females
- Patients with life expectancy <3 months
- Current anticoagulant therapy for >48 hrs
- Suspected upper limb DVT

Methodology: 500 patients were included as per the inclusion criteria who were admitted to the surgical wards. Detailed history was taken and physical examination was done. The Well's score and the score on Autar risk assessment scale were calculated for each patient. All patients underwent chest x-ray, ecg and bilateral lower limb arterio-venous Doppler. Outcomes were measured in terms of whether the patient developed DVT or not.

Statistical analysis: The software used in the analysis were SPSS 24.0 and $p<0.05$ is considered as level of significance.

RESULTS

Of 500 cases studied, the most common age group involved was 31-40 with 109 cases (21.8%). The distribution of Mean±SD of cases studied was 45.4± 15.9 yrs and the minimum-maximum age range was 18 90 years. Of 500 cases studied, 374 (74.8%) were males and 126 (25.2%) were females. The male to female sex ratio in the entire study group was 2.97:1.00. Of 500 cases studied, 178 (35.6%) had pain, 125 (25.0%) had trauma, 106 (21.2%) had swelling of limbs, 56 (11.2%) had immobilization, 33 (6.6%) were on medication, 28 (5.6%) had other co-morbidity, 28 (5.6%) had tenderness, 20 (4.0%) had active cancer treatment and 1 (0.2%) had previous DVT.

Of 500 cases studied, 331 (66.2%) had normal Doppler study, 86 (17.2%) had DVT, 56 (11.2%) had PVD and 27 (5.4%) had venous incompetence. Of 500

Table 1: General characteristics

Age Group (years)	No. of cases	Percentage of cases
=30	105	21.0
31–40	109	21.8
41–50	101	20.2
51–60	94	18.8
61–70	59	11.8
>70	32	6.4
Sex		
Male	374	74.8
Female	126	25.2
Clinical history		
Pain	178	35.6
Trauma	125	25.0
Swelling of limbs	106	21.2
Immobilization	56	11.2
On medication	33	6.6
Co-morbidity	28	5.6
Tenderness	28	5.6
Active cancer treatment	20	4.0
Previous DVT	1	0.2

Table 2: Distribution of colour doppler and chest X ray findings in the study group

Colour Doppler findings	No. of cases	Percentage of cases
Normal	331	66.2
DVT	86	17.2
PVD	56	11.2
Venous Incompetence	27	5.4
Chest X-ray findings		
Nil	488	97.6
Rib fracture	8	1.6
Clavicle fracture	1	0.2
COPD	1	0.2
Pleural effusion	1	0.2
Lung collapse	1	0.2
Total	500	100.0

Table 3: Distribution of Well's score, AUTAR's score

Wells's score	No. of cases	Percentage of cases
0–1	406	81.2
2–3	94	18.8
AUTAR's score		
=10 (Low risk)	462	92.4
11–14 (Moderate risk)	34	6.8
=15 (High risk)	4	0.8

cases studied, 488 (97.6%) had normal Chest X-ray findings, 8 (1.6%) had rib fracture, 1 (0.2%) had clavicle fracture, 1 (0.2%) had COPD, 1 (0.2%) had pleural effusion and 1 (0.2%) had lung collapse. Of 500 cases studied, 406 (81.2%) had Well's score between 0-1, 94 (18.8%) had Well's score between 2-3. Of 500 cases studied, 462 (92.4%) had AUTAR's score less than or equal to 10, 34 (6.8%) had AUTAR's score between 11-14 and 4 (0.8%) had AUTAR's score more than or equal to 15.

The distribution of colour Doppler findings differs significantly across two groups of Well's score ($p<0.001$). Significantly higher proportion of cases with Well's score between 0-1 had normal colour Doppler and significantly higher proportion of cases with Well's score between 2-3 had DVT on colour Doppler ($p<0.001$). The sensitivity, specificity, PPV, NPV and accuracy of Well's score (= 2) for predicting the DVT against Colour Doppler findings as a Gold standard is 100.0, 98.1, 91.5, 100.0 and 98.4% respectively. The distribution of colour Doppler findings differs significantly across three groups of AUTAR's score ($p<0.05$). Significantly higher proportion of cases with AUTAR's score in three groups (low risk to high risk) had normal colour Doppler ($p<0.05$). The sensitivity, specificity, PPV, NPV and accuracy of AUTAR's (>10) for predicting the DVT against Colour Doppler findings as a Gold standard is 1.2%, 91.1-2.6%, 81.6-75.6% respectively.

DISCUSSIONS

Around the world, trauma is responsible for 5.7 million deaths annually, accounting for 25-33% of unintentional deaths of those under 45 yrs of age and 90% of the global trauma burden in low and middle-income countries[16] Multiple trauma, also known as polytrauma, is an injury to two or more anatomical sites caused by a single factor, of which at least one site is life-threatening. The interaction between injury regions with multiple injuries can aggravate the condition, the clinical treatment is difficult and the patients who survived the trauma are at risk of life-threatening complications, such as respiratory complications, multiple organ dysfunction syndrome and venous thromboembolism (VTE)[17-19]. Previous studies investigated the incidence and risk factors of DVT in orthopedics patients, but few assessed the prevalence of DVT in multiple trauma population groups. In this study, 55 patients were diagnosed with DVT, accounting for 26.19% and distal DVTs were dominant (87.27%). In a study of 716 trauma patients, adequate venography found that 58% of patients had lower extremity DVT; 18% had proximal DVT[20]. However, the incidence of lower extremity DVT in trauma patients who have received thromboprophylaxis was still as high as 12 65%[21]. Sun *et al*.[22] found that, even with conventional prevention, the incidence of DVT in multiple trauma patients was as high as 42.08%, of which the incidence of proximal DVT was 6.56% and that of distal DVT was 35.52%.

Of 500 cases studied, the most common age group involved was 31-40 with 109 cases (21.8%). The distribution of Mean±SD of cases studied was 45.4±15.9 yrs and the minimum-maximum age range was 18-90 yrs. Of 500 cases studied, 374 (74.8%) were males and 126 (25.2%) were females. The male to female sex ratio in the entire study group was 2.97: 1.00. Of 500 cases studied, 178 (35.6%) had pain, 125 (25.0%) had trauma, 106 (21.2%) had swelling of limbs, 56 (11.2%) had immobilization, 33 (6.6%) were on medication, 28 (5.6%) had other co-morbidity, 28 (5.6%) had tenderness, 20 (4.0%) had active cancer treatment and 1 (0.2%) had previous DVT. Of 500 cases studied, 331 (66.2%) had normal Doppler study, 86 (17.2%) had DVT, 56 (11.2%) had PVD and 27 (5.4%) had venous incompetence. Of 500 cases studied, 488 (97.6%) had normal Chest X-ray findings, 8 (1.6%) had rib fracture, 1 (0.2%) had clavicle fracture, 1 (0.2%) had

Table 4: Distribution of color doppler findings according to well's score

	Well's score						
	0-1		2-3		Total		
Colour Doppler findings	n	%	n	%	n	%	p-value
Normal	329	81.0	2	2.1	331	66.2	0.001
PVD	55	13.5	1	1.1	56	11.2	
DVT	0	0.0	86	91.5	86	17.2	
Venous Incompetence	22	5.4	5	5.3	27	5.4	
Total	406	100.0	94	100.0	500	100.0	

Table 5: The distribution of diagnostic efficacy indices of Well's score (= 2) against the Colour Doppler findings as a Gold standard for predicting DVT

	Sensitivity	Specificity	Positive predictive value (PPV)	Negative predictive value (NPV)	Accuracy
Value (%)	100.0	98.1	91.5	100.0	98.4

Table 6: Distribution of Color Doppler Findings according to AUTAR's score

	AUTAR's Score								
	=10 (Low Risk)		11-14(Moderate Risk)		=15 (HighRisk)		Total		
Colour Doppler findings	n	%	n	%	n	%	n	%	p-value
Normal	307	66.5	22	64.7	2	50.0	331	66.2	0.012
PVD	49	10.6	6	17.6	1	25.0	56	11.2	
DVT	85	18.4	1	2.9	0	0.0	86	17.2	
Venous incompetence	21	4.5	5	14.7	1	25.0	27	5.4	
Total	462	100.0	34	100.0	4	100.0	500	100.0	

Table 7: The distribution of diagnostic efficacy indices of AUTAR's score (>10) against the Colour Doppler findings as a Gold standard for predicting DVT

Sensitivity	Specificity	Positive predictive value (PPV)	Negative predictive value (NPV)	Accuracy value (%)
1.2	91.1	2.6	81.6	75.6

COPD, 1 (0.2%) had pleural effusion and 1 (0.2%) had lung collapse. Of 500 cases studied, 406 (81.2%) had Well's score between 0-1, 94 (18.8%) had Well's score between 2-3. Of 500 cases studied, 462 (92.4%) had AUTAR's score less than or equal to 10, 34 (6.8%) had AUTAR's score between 11-14 and 4 (0.8%) had AUTAR's score more than or equal to 15. The distribution of colour Doppler findings differs significantly across two groups of Well's score (p-value<0.001). Significantly higher proportion of cases with Well's score between 0-1 had normal colour Doppler and significantly higher proportion of cases with Well's score between 2-3 had DVT on colour Doppler (P-value<0.001). According to the present study the sensitivity for Autar risk assessment scale for all risk groups is 1.2%, specificity being 91.1%, PPV 2.6% and NPV 81.6%. Hence the accuracy of Autar risk assessment scale was calculated to be 75.6%. According to the present study the sensitivity of Well's score is 100%, specificity being 98.1%, PPV was 91.5% and NPV being 100%. Hence the accuracy of Well's score was calculated to be 98.4%. According to an research article published in World Journal of emergency surgery in the year 2016 by Shrey et al. Out of 298 patients evaluated, 18 (6 %) patients were positive for DVT. A linear correlation was present between Wells score and DVT with R2= 0.88 (p = 0.0016). Area under ROC curve was 0.859 (p<0.0001) demonstrating the accuracy of Wells scoring system for DVT risk stratification in post trauma patients. Taking cut-off score as 2, the sensitivity of Well's score was calculated to be 67%, specificity 90%, PPV 31%, NPV 98%[23]. According to a study conducted by D. Gatot and A.I.Mardia the sensitivity of Well's score in diagnosing DVT was 80.6%, specificity being 80.65% and accuracy was found to be 87.5%. As compared to the present study all three parameters are lower[24]. According a study conducted by Malgorzata Dybowska *et al*. the sensitivity of Well's score taking 2 as a cut off value was 66.66%, specificity being 93.93%, PPV was found to be 40.0% and NPV was calculated to be 97.89%. As compared to the present study the specificity and NPV have shown close results[25].

CONCLUSION

DVT is a serious and critical clinical condition that causes severe morbidity and mortality which could be prevented. Diagnosis of DVT presents a clinical challenge for physician. Risk-factor evaluation with Wells scoring system, D-dimer examination and venous ultrasonography can facilitate the prediction and identification of DVT From the results of the present study it is evident that early prediction of DVT can be done by using the Well's score and hence, early preventive measures can be taken to avoid the occurrence of DVT and its related complications.

REFERENCES

1. Bendinelli, C. and Z. Balogh, 2008. Postinjury thromboprophylaxis. Curr. Opin. Crit. Care., 14: 673-678.
2. Dunbar, N.M. and W.L. Chandler, 2009. Transfusion practice: Thrombin generation in trauma patients. Transfusion, 49: 2652-2660.

3. Roger, F.B., 2001. Venous thromboembolism in trauma patients: A review. Surgery, 130: 1-12.
4. Toker, S., D.J. Hak and S.J. Morgan, 2011. Deep vein thrombosis prophylaxis in trauma patients. Thrombosis, 2011: 1-11.
5. Boddi, M. and A. Peris, 2016. Deep vein thrombosis in intensive care. Adv. Exp. Med. Biol., 1: 167-181.
6. Zhang, Y., P.A. Coello, J. Brozek, W. Wiercioch and I. Etxeandia-Ikobaltzeta et al., 2017. Using patient values and preferences to inform the importance of health outcomes in practice guideline development following the grade approach. Health. Qual. Life. Outcomes., Vol. 15 .10.1186/s12955-017-0621-0
7. Musil, D., M. Kaletová and J. Herman, 2016. Venous thromboembolism-prevalence and risk factors in chronic venous disease patients. Phlebology. J. Venous Dis., 32: 135-140.
8. NÆSS, I.A., S.C. CHRISTIANSEN, P. ROMUNDSTAD, S.C. CANNEGIETER, F.R. ROSENDAAL and J. HAMMERSTRØM, 2007. Incidence and mortality of venous thrombosis: A population-based study. J. Thrombosis Haemostasis, 5: 692-699.
9. Kyrle, P.A., E. Minar, C. Bialonczyk, M. Hirschl, A. Weltermann and S. Eichinger, 2004. The risk of recurrent venous thromboembolism in men and women. New. Engl. J. Med., 350: 2558-2563.
10. Caldeira, D., F.B. Rodrigues, M. Barra, A.T. Santos and D. de Abreu et al., 2015. Non-vitamin k antagonist oral anticoagulants and major bleeding-related fatality in patients with atrial fibrillation and venous thromboembolism: A systematic review and meta-analysis. Heart, 101: 1204-1211.
11. Bailey, P.M., 2005. Venous thromboembolism: Diagnosis and management of pulmonary embolism. Med. J. Australia, 183: 220-221.
12. Wells, P.S., 1998. Use of a clinical model for safe management of patients with suspected pulmonary embolism. Ann. Internal Med., 129: 997-1005.
13. Gal, G.L., M. Righini, P.M. Roy, O. Sanchez, D. Aujesky, H. Bounameaux and A. Perrier, 2006. Prediction of pulmonary embolism in the emergency department: The revised geneva score. Ann. Internal Med., 144: 165-171.
14. Autar, R., 2003. The management of deep vein thrombosis: The autar dvt risk assessment scale re-visited. J. Orthop. Nurs., 7: 114-124.
15. Muñiz, S.A., R.W. Lang, L. Falcon, J. Garces-King, S. Willard and G.L. Peck, 2017. Preparing global trauma nurses for leadership roles in global trauma systems. J. Trauma. Nurs., 24: 306-311.
16. Ruskin, K.J., 2018. Deep vein thrombosis and venous thromboembolism in trauma. Curr. Opin. Anaesthesiol., 31: 215-218.
17. Zeng, L., W. Gu, A.Q. Zhang, M. Zhang and L.Y. Zhang et al., 2012. A functional variant of lipopolysaccharide binding protein predisposes to sepsis and organ dysfunction in patients with major trauma. Ann. Surg., 255: 147-157.
18. Jakobsen, R.K., A. Bonde and M. Sillesen, 2021. Assessment of post-trauma complications in eight million trauma cases over a decade in the usa. Trauma Surg. Acute. Care. Open., Vol. 6 .10.1136/tsaco-2020-000667.
19. Geerts, W.H., K.I. Code, R.M. Jay, E. Chen and J.P. Szalai, 1994. A prospective study of venous thromboembolism after major trauma. New Engl. J. Med., 331: 1601-1606.
20. Chung, S.B., S.H. Lee, E.S. Kim and W. Eoh, 2011. Incidence of deep vein thrombosis after spinal cord injury: A prospective study in 37 consecutive patients with traumatic or nontraumatic spinal cord injury treated by mechanical prophylaxis. J. Trauma: Injury, Infec. Crit. Care, 71: 867-871.
21. Sun J, P. Wang, H. Xue, B. Zhang, S. Liu, L. Sun, Z. Lia and K. Zhang, 2019. Incidence and risk factors of intraoperative deep venous thrombosis in patients with multiple injuries. Chinese. J. Orthopaedic. Trauma., 1: 39-43.
22. Modi, S., R. Deisler, K. Gozel, P. Reicks and E. Irwin *et al.,* 2016. Wells criteria for dvt is a reliable clinical tool to assess the risk of deep venous thrombosis in trauma patients. World. J. Emergency. Surg., 11: 1-6.
23. Gatot, D. and A.I. Mardia, 2018. Differences of wells scores accuracy, caprini scores and padua scores in deep vein thrombosis diagnosis. IOP Conf. Ser. Earth Environ. Sci., Vol. 125 .10.1088/1755-1315/125/1/012131
24. Dybowska, M., W.Z. Tomkowski, P. Kuca, R. Ubysz, A. Józwik and D. Chmielewski, 2015. Analysis of the accuracy of the wells scale in assessing the probability of lower limb deep vein thrombosis in primary care patients practice. Thrombosis. J., 13: 1-5.