

## Original Research Article

# A study on the effectiveness of wells criteria for diagnosing deep vein thrombosis: a prospective observational study

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## ABSTRACT

**Background:** Wells score which takes into account various aspects in the history as well as various clinical signs which can help the clinician to arrive at a diagnosis of deep vein thrombosis (DVT). This helps to save time and money that is wasted in doing many unnecessary investigations. Aim of the study was to test the application of the Wells score in our clinical set up and to see how effectively we can diagnose DVT.

**Methods:** This was a prospective diagnostic validation study of the wells rule for DVT in our setup, ultrasound (USG) being the gold standard comparison and will be conducted over a duration of 12 months. Wells score for each patient was calculated and the results were evaluated.

**Results:** Among the 50 cases suspected DVT, the wells score was able to predict DVT in 46 of the cases thus proving to be a very efficient diagnostic indicator. The average wells score among the various cases was 4/8. Complications noted in the study group were 2 cases of cortical vein thrombosis in the post-partum period which fully recovered. Mortality rate in the study group was 4.3% in which a single case of diagnosed myocardial infarction died of heart failure.

**Conclusions:** Wells score is indeed a very good predictive criteria for DVT and can be applied with ease as it required only clinical assessment and thus avoids unnecessary delays in waiting for scans thereby allowing us to start anticoagulants as early as possible.

**Keywords:** DVT, Mortality, Thrombosis, Wells score

## INTRODUCTION

Phlebothrombosis is a disease which remains symptom free till complications like pulmonary embolism becomes obvious. It was considered that the efficient return of blood from the veins of the extremities depends on various factors. The disturbance of any one or a combination of these factors may result in sufficient stasis to produce phlebothrombosis. Phlebothrombosis of deep veins is clinically silent and manifests only as its complications. Early recognition of the process of venous phlebothrombosis, its pathophysiology and availability of Doppler study has remarkably reduced the incidence of

Pulmonary emboli and its consequences by instituting early management.<sup>1</sup>

However, all said and done man remains unwary and takes for granted the many magical functions that our veins do quietly in the background until they start malfunctioning. Deep vein thrombosis (DVT) is a preventable condition that causes significant morbidity and mortality. Statistics show that complications from DVT kills more people than breast cancer and AIDS combined.<sup>2</sup> Current contraindications against initiation of prophylaxis against DVT (with low molecular weight heparin (LMWH)) include intracranial bleed, internal

bleeding from the raw wounds and operated sites bleed, spinal bleeding following spinal anesthesia and spinal injury due to hematoma.

The DVT results in the patient suffering which is significantly higher in the post op period or during period of hospitalization. This causes significant raise in the expense to the patient due to prolonged period of stay in the hospital and also ends in wastage of precious hospital resources and manpower.<sup>3</sup>

The clinical diagnosis of DVT is not only challenging but may mimic other conditions as well, thereby making it risky to start empirical therapy with anticoagulants. Advanced imaging facilities such as Doppler venous ultrasound may not be always available in peripheral hospitals. Due to delay in the diagnosis, the treatment also gets delayed resulting in wasting precious time.

There are many instances in which clinical assessment with Homan's and Mose's sign have yielded false positives and assessment based on these clinical signs alone may be inadequate. A clinical scoring system has been developed namely Aims were to assess the efficacy of Wells criteria for diagnosing deep vein thrombosis and to bring into light the associated co morbid conditions and to find out the most significant one which has got the highest probability for causing DVT.

## METHODS

This was a prospective diagnostic validation study of the Wells Rule for DVT in our setup, ultrasound (USG) being the gold standard comparison. It was conducted in Department of General Surgery, Government Stanley medical college, Chennai for a period of one year (January 2018 to December 2018). Score for each patient will be calculated based on the parameters given as.<sup>5</sup>

**Table 1: Wells clinical prediction rule for Deep Venous Thrombosis (DVT).**

Clinical feature	Points
Active cancer (treatment within 6 months, or palliation)	1
Paralysis, paresis, or immobilization of lower extremity	1
Bedridden for more than 3 days because of surgery (within 4 weeks)	1
Localized tenderness along distribution of deep veins	1
Entire leg swollen	1
Unilateral calf swelling of greater than 3 cm (below tibial tuberosity)	1
Unilateral pitting edema	1
Collateral superficial veins	1
Alternative diagnosis as likely as or more likely than DVT	-2
<b>Total points</b>	

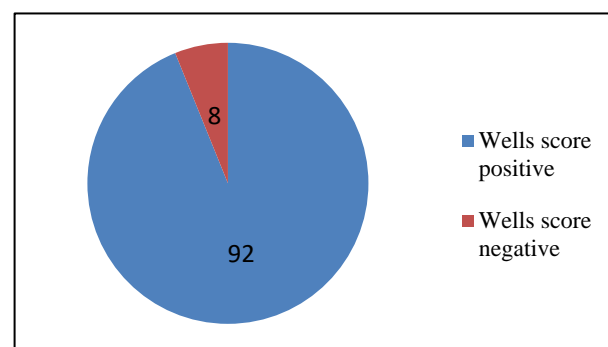
Risk score interpretation (probability of DVT)/=3 points: high risk (75%); 1 to 2 points: moderate risk (17%); 1 point: low risk (3%). Fifty patients admitted with a clinical diagnosis of DVT was considered as the sample size. This study included patients age greater than 18 years, onset of symptoms within 7 days and those consenting to the study. This study excluded patients with recurrent DVT and patients with bleeding diathesis.

All patients with suspected DVT was assigned a Wells score on admission and followed up by venous Doppler USG to confirm the diagnosis. The correlation between the Wells score and Doppler was checked. Basic blood investigations were taken. In every step of the study patient safety was given top most preference. All procedures were done under strict aseptic precautions and only necessary investigations will be carried out after carefully evaluating the patient.

All procedures were done only after getting consent of the patient or the attender. This study was basically to test the effectiveness of Wells criteria as a diagnostic tool in DVT. Wells score application was allowed the clinician prepared for the diagnosis even before the confirmation by a venous doppler USG thus saving time in initiating treatment and thereby enabling faster patient recovery.

## RESULTS

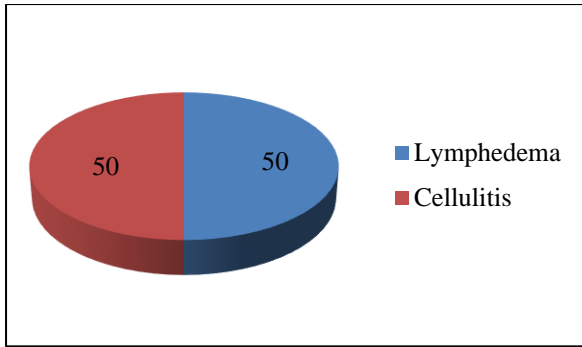
Fifty patients admitted with a diagnosis of deep vein thrombosis in various departments was studied prospectively between September 2012 and November 2013. The Wells score was applied on a total of 50 cases. Out of the total number of cases it was able to diagnose DVT in 92% of the cases i.e. 46 out of 50 cases. Thus proving to be a very accurate indicator for DVT (Figure 1).



**Figure 1: Wells score diagnosed cases.**

### Wells score false positive

On analyzing the Wells score negative cases two of the cases were symptomatic due to acute lymphedema in elderly woman suffering from intra-abdominal malignancy and the other two cases were early onset cellulitis (Figure 2).

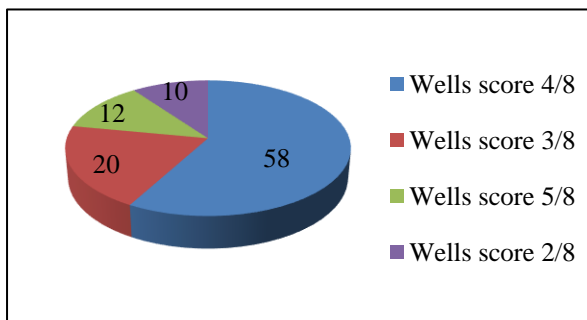


**Figure 2: Wells score false positive cases.**

Out of the 4 cases which did not have DVT the highest wells score was 5/8 which included 2 elderly women with intra-abdominal malignancy-namely carcinoma of the cervix thus blocking all the lymphatics resulting in tense lymphedema of the leg. The entire leg thus having the appearance of inverted beer bottle appearance similar to acute DVT. Both cases had undergone radiotherapy for cervical cancer a few years ago.

#### Wells score distribution

Most of the cases diagnosed with DVT had a Wells score of 4/8 which being above 3 thus indicates a 75% risk of having deep venous thrombosis. 29 of the cases had a Wells score of 4/8. Followed by 10 cases which were also in the same risk category with a score of 3/8. Six cases had the highest score of 5/8 which were also in the highest risk category out of which 2 did not have DVT and were having lymphedema. The other 2 cases were having the lowest score of 2/8 which put them in the moderate risk category for having DVT which was a risk of 17% (Figure 3).

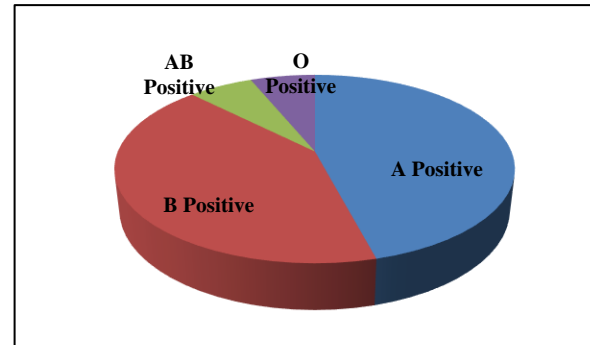


**Figure 3: Wells score distribution.**

#### Blood group distribution in DVT cases

On observing the distribution of blood groups in the entire case list of DVT confirmed cases 22 of the 46 confirmed cases of DVT ie 47.82 % had blood group A positive. This was followed by 19 cases which amounted to 41.30 % which had blood group B positive, the rest were AB positive i.e. 3 amounting to 6.52 % and finally O positive which consisted of 2 cases amounting to

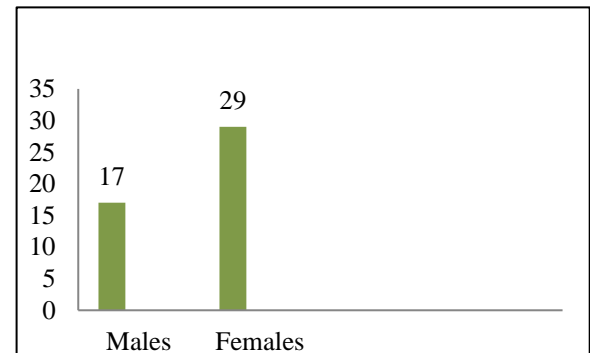
4.34% of the cases (Figure 4). This in turn compliments various studies which suggest a higher rate of deep vein thrombosis in individuals with blood group A.



**Figure 4: Blood group distribution.**

#### Sex distribution of DVT cases

On taking into account the sex distribution of cases of DVT it can be seen that the number of DVT cases are much higher in women on our hospital due to the high incidence of DVT in post-partum females. This is almost double the ratio of males affected by DVT. 29 females out of the total of 46 were affected which constituted 63% (Figure 5).



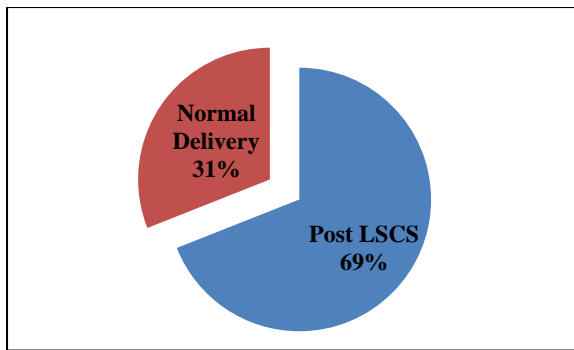
**Figure 5: Sex Distribution.**

#### DVT in LSCS vs normal delivery

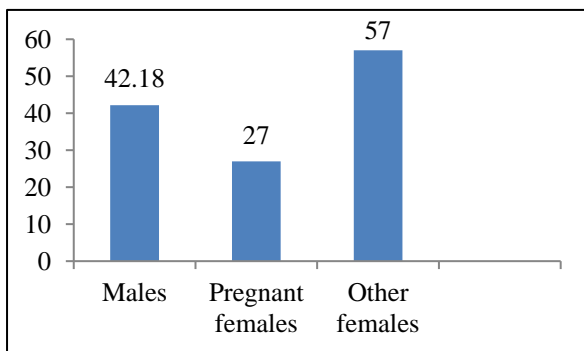
There was a higher proportion of cases of DVT in females who underwent caesarean section when compared to those who underwent normal delivery. This is understandably due to the prolonged period of immobilization and pregnancy itself which is a prothrombotic state. Out of the total of 26 pregnant females with DVT 18 had undergone caesarean section and 8 underwent normal delivery (Figure 6).

#### Age distribution of cases

The average age of male patients with DVT was 42 years whereas in case of pregnant females it was 27 years and non pregnant females it was 57 years (Figure 7).



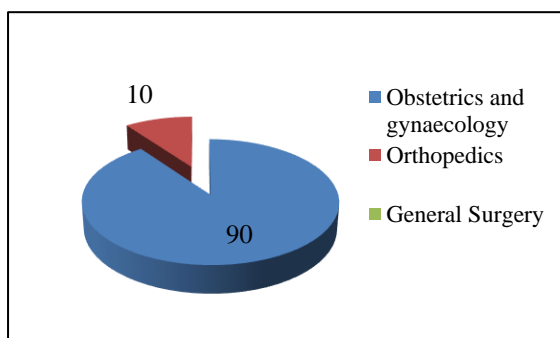
**Figure 6: DVT in LSCS vs normal Delivery.**



**Figure 7: Average age distribution.**

#### **DVT in post op cases**

Out of the total number of post op cases with DVT 90% of the cases with DVT were post caesarean section followed by orthopedics. No post-operative cases in general surgery were reported to have DVT. This could be possibly due to early mobilization of the post operative cases and passive flexion exercises advocated in the post-operative wards (Figure 8).



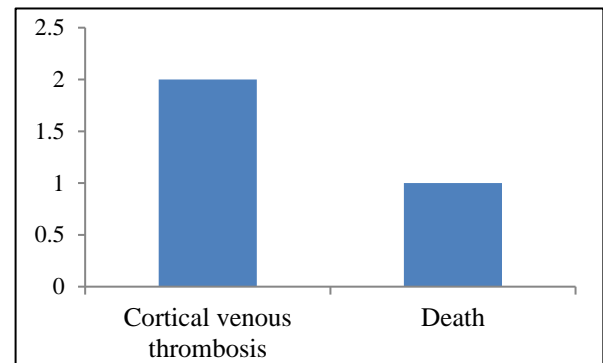
**Figure 8: DVT in post op cases.**

Total post op cases with DVT-20; LSCS cases-18; Orthopedics cases- 2; General Surgery-0.

#### **Complications seen in the study group**

Out of the 46 cases of DVT 3 went in for complications. Out of the three cases 2 were female who had just

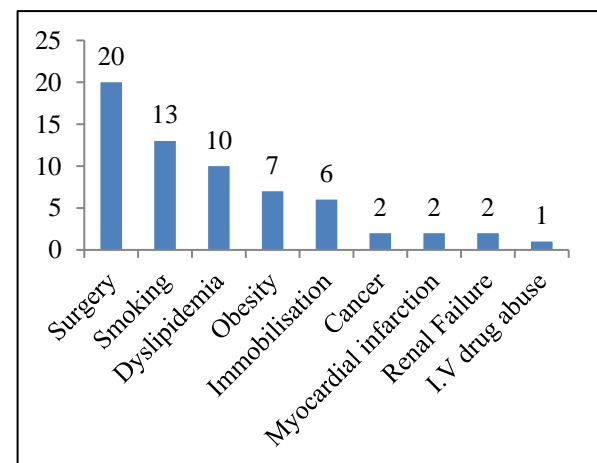
delivered and had gone in for cerebral venous thrombosis. This was resolved by standard dose of heparin titrated according to PT/INR values. One male patient died as he went in for cardiac complications due to myocardial infarction (Figure 9).



**Figure 9: Complications seen.**

#### **Analysis of co morbidities**

On analyzing the associated co morbidities in the study group it is clear that surgery was the most significant contributing factor resulting in DVT. In our study group most of the surgical cases were post caesarean section. Other co morbid conditions in descending order are smoking, dyslipidemia, obesity, immobilization, cancer, myocardial infarction, renal failure and cancer. Finally a single case of IV drug abuse was also reported to have DVT (Figure 10).



**Figure 10: Comorbid conditions resulting in DVT.**

#### **DISCUSSION**

DVT is a condition which occurs in any location within the venous circulation. Majority of DVT are known to occur within the deep veins of the leg, followed by the pelvis. Occasionally deep vein thrombosis also occurs in the cerebral venous sinuses which was seen in two of the post partum cases in our study.

The wells score was applied to 50 cases out of which 46 were proven to have DVT by Venous Doppler USG. Out of the proven cases of DVT there was a female predominance of cases in a ratio of 1.7:1. Out of the total number of cases 63.04% was female and the remaining 36.96 were male. This is very much in concordance with a study done in New Zealand by Maelen Tagelagi and co-workers where 62% were women.<sup>1</sup>

However according to the New Zealand study the Wells Score was not so effective in their setup unlike the high predictive rate i.e. 46 out of 50 suspected cases seen in our study.<sup>5</sup> Among the false positive cases 2 were due to malignancy of the cervix who had underwent radiotherapy, the other two were due to early onset cellulitis. Lymph edema is known to develop in cancer by various mechanisms.

Extensive lymph nodal dissection following surgery is known to be the primary cause. Following surgery for cancer radiotherapy also causes scarring of the lymph nodes and lymph vessels. Also tumor embolus is also known to block lymph vessels. Any cancer is a predisposing factor for unprovoked DVT which has been mentioned by Ruud Oudega and coworkers.<sup>6</sup>

Lymphedema also develops in cellulitis due to stagnation of protein rich lymphatic fluid which prove to be a rich medium for bacteria to grow thus creating a vicious cycle. On analysis of the average Wells score seen in the DVT positive cases 29 out of the 46 cases had a Wells score of 4 out of 8 which specifies a 75% or greater chance of having DVT.<sup>1</sup> The average age for male DVT cases in our study group was 42 years, pregnant females 27 followed by a sudden rise in age which were mostly post-menopausal women with cancer. Pregnant women have a five fold chance of having DVT compared to non pregnant women.<sup>3-5</sup>

This again correlates with the statistics given by Office of the Surgeon General (US) and the National Heart, Lung, and Blood Institute (US).<sup>7</sup> It was also seen that there was a higher incidence of DVT in those individuals with non O blood groups. In our study majority of the cases of DVT were having a positive blood group thus indicating a higher level of plasma Von Willebrand factor, possibly a mutated variant. This correlated with the studies by Massimo Franchini and Mike Makris.<sup>4,8</sup> Among the cases of DVT which had occurred in the post operative period, the highest incidence of DVT was following caesarean section, followed by orthopedics in polytrauma cases.

There was no case of DVT in the General surgery post operative ward in our study group. This could have been due to the early mobilization of cases in post op wards and advocacy of passive flexion exercises. There is also evidence in literature as written by Victor. supporting that smoking also creates a procoagulant state by increasing platelet activation, decreasing fibrinolysis and various other mechanisms which puts smoking as a very high risk

factor for DVT.<sup>9</sup> Joel et al literature also suggests that dyslipidemia has a role to play in DVT which could also be seen in some of our cases.<sup>10</sup> Finally there was a single case of IV drug abuse who had tested positive for DVT, the link between DVT and intravenous drug abuse being already proved by Cooke et al in England.<sup>11</sup>

## CONCLUSION

This study concluded that the Wells score is indeed a very good predictive criteria for deep venous thrombosis and can be applied with ease as it required only clinical assessment and thus avoids unnecessary delays in waiting for scans thereby allowing us to start anticoagulants as early as possible.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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